TEKMAR 3100
PURGE AND TRAP CONCENTRATOR

User Manual

Tekmar-DOHRMANN™

TEKMAR 3100

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User Manual

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Patents are pending on the Tekmar 3100 Purge and Trap Concentrator.

Tekmar-DOHRMANN™

7143 East Kemper Road, Cincinnati, Ohio 45249
(800) 543-4461 • Outside the U.S. and Canada (513) 247-7000 • Service (800) 874-2004
Fax (513) 247-7050 • www.tekmar.com
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INTRODUCTION

Chapter 1

1.1 Overview

This section describes the 3100 Purge and Trap Concentrator, defines its basic functions and system configurations, provides technical specifications, and outlines safety considerations for its use.

1.2 Product Description

The 3100 (Figure 1-1) is a purge and trap concentrator that allows automatic processing of liquid and soil samples for analysis by gas chromatography. The concentrator operates and interfaces with the gas chromatograph (GC) under microprocessor control.

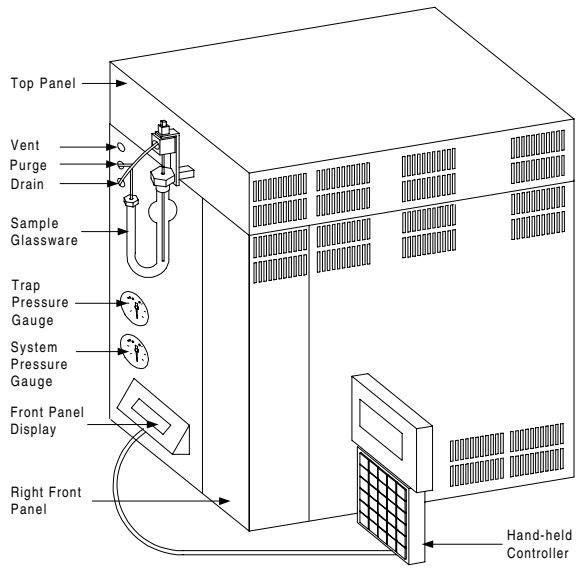


Figure 1-1 Tekmar 3100

The 3100 is equipped with:

- Sample glassware for processing single samples.
- A front panel trap pressure gauge that shows the current system pressure (in psi) for each mode.
- A front panel LCD screen that displays information about the concentrator's current operating step.
- ON/OFF switch on the back panel.
- A hand-held controller (purchased separately). The controller consists of a four-line, 20-character wide, LCD (liquid crystal display) and a 30- button keypad. You communicate with the 3100 microprocessor by using the keypad and display screen on the hand-held controller.

1.3 Concentrator Functions

The 3100 purges volatile organic compounds from water or soil onto a sorbent trap. The trap is then rapidly heated; the analytes are swept with GC carrier gas onto the column for separation and detection, as shown in Figure 1-2.

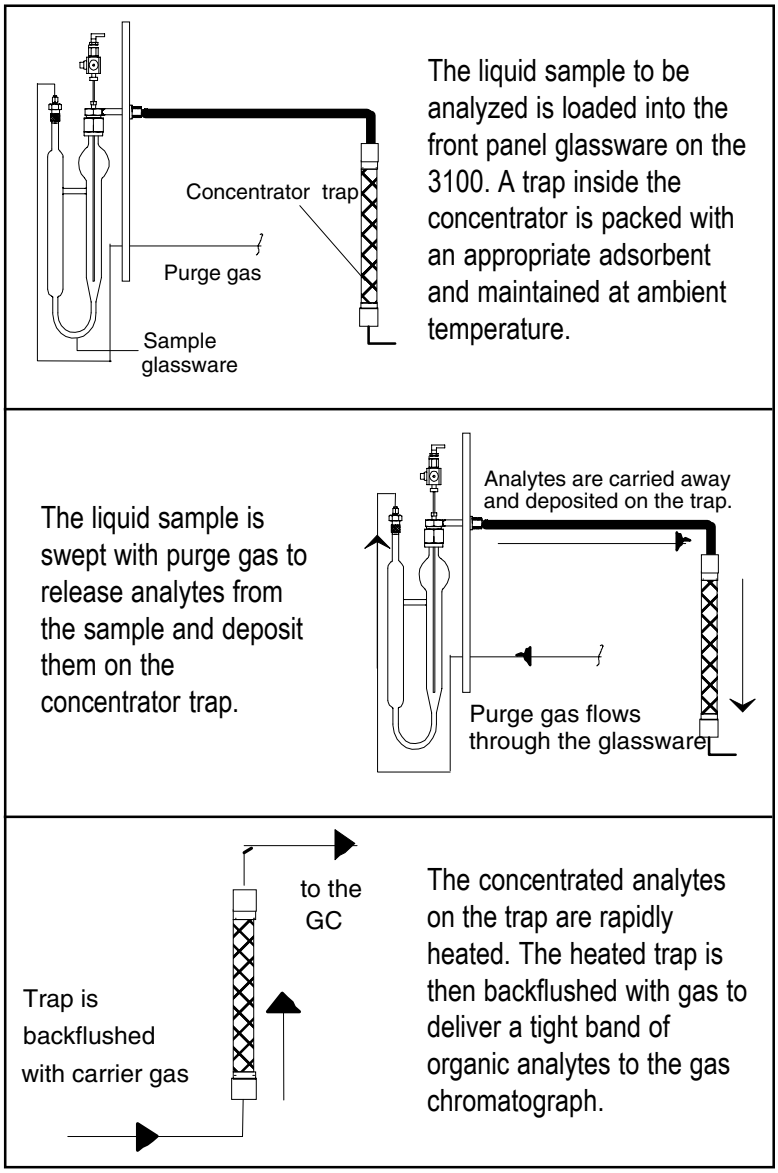


Figure 1-2 3100 Functions

1.4 System Configurations

The 3100 concentrator processes a single sample and delivers the resulting analytes to a gas chromatograph. You may also use the 3100 with other Tekmar-Dohrmann accessories which can extend and enhance 3100 functions. Please refer to the appropriate user manuals for further information.

1.4.1 Tekmar 3100 with Cryofocusing Module

For enhanced sensitivity and chromatographic resolution when analyzing highly volatile compounds on a small bore capillary column, Tekmar-Dohrmann recommends that you use the Cryofocusing Module with the 3100.

- Highly volatile components desorbed from the internal trap of the 3100 are refocused and condensed in the trapping area of the Cryofocusing Module as carrier gas goes through the module to the GC.
- The Cryofocusing Module freezes the condensed components in a narrow, cryofocused band on the column.
- The Cryofocusing Module is flash heated and flushed with carrier gas to release the analytes on the GC column.

1.5 Specifications for the 3100

This section gives you specifications for the 3100. Please refer to the appropriate user guide for autosampler specifications.

Utility Requirements:

Voltage:	100/115/230 volts (+/- 10%)
Frequency:	50/60 hertz (+1%)
Current:	5.0/4.0 amps
Power:	550 watts
Btu per hour:	1877

Operating Environment:

The 3100 operates at temperatures between 19°C (66°F) to 60°C (140°F) with humidity levels between 10% and 90%.

Weight:

65 lbs. (29.48 kg.)

Dimensions:

Height:	19" (48.3 cm)
Width:	9" (22.9 cm)
Depth:	18" (45.7 cm) deep

Gas SupplyRequirements:

Ultra-high purity (99.999%) helium or nitrogen as purge gas, supplied at 20 psig

Sample Glassware:

The standard sampler is a 5 ml frit sparger, with all-glass construction using a medium-porosity glass frit. Optional glassware is: 25 ml frit sparger, 5 or 25 ml fritless sparger, 5 or 25 ml needle sparger and 25 ml disposable test tubes.

Trap:

12" long; stainless steel tube; 0.010" wall thickness; 0.123" +/- 0.002" OD (maximum OD of 0.125" is the USEPA specified standard)

Trap Furnace:

Controlled temperature range: from 5°C above ambient* to 420°C (-20°C to 420°C with optional TURBOCool); average rise rate: 660°C/min. from 35°C to 225°C (The rise rate is averaged over this temperature span; it is invalid outside this span.)

* temperature of the surrounding air

Trap Pressure Control™:	Variable; set at the factory to maintain a recommended back pressure of 4 psi; flow rate: 35 ml/min.
Valving:	• A 115 VAC motor-actuated, 6-port switching valve with removable rotor; temperature controlled from ambient to 300°C • 12 VDC solenoid-actuated, 2 and 3-port sample, bypass, high rate purge (HRP), drain and vent valves
Sample Path:	• Flow Tuned Tubing (FTT)™ features constant uniform internal diameters on all fittings, valves and tubing; eliminates dead volume and maintains a constant linear velocity during desorption to the gas chromatograph • Transfer line, 72" total length - 60" outside of unit; heated, variable: ambient to 300°C • Optional sample pocket and tube heaters; variable: from ambient to 100°C
Carryover Specifications:	• 3100 concentrator: 0.1% after 1000 ng standard There is no difference between carryover amounts using U-shaped glassware versus needle sparger glassware (with or without drain).
Operating Range of Concentration:	Calibration range: 0.5 ng to 2000 ng System range: low ppt to 10 ppm
LN_2 Consumption:	When using a Cryofocusing Module: Approximately 1 liter to cool the cryofocus trap to -120°C. Then 1/4 liter per minute once the cooldown temperature is reached (total time for Desorb Preheat and Desorb modes.)
Moisture Control System:	Removes moisture from the gas stream going to the GC; operating temperature: 5°C above ambient to 400°C
Electronic Control:	Microprocessor - Motorola 68000, running at 12 MHz CPU memory - 128K ROM; 64K RAM (expandable to 128K)
Baud Rate:	9600

Data Input:

The 3100 accepts parameter values that you enter by way of an RS232C serial interface. To enter the parameter values, use one of the following:

- A hand-held controller connected directly to an I/O port
- A personal computer with optional TekLink software. To use TekLink, you must have the following:
  1. 80386 or greater computer running Microsoft® Windows™ version 3.1 or later
  2. Any kind of DOS (version 5.0 or greater)
  3. Hard drive with at least 2 MB (two megabytes) of free space
  4. 4 MB of RAM (8 MB recommended)
  5. Disk drive that reads 3 1/2" 1.44MB diskettes
  6. At least one free serial port for connection to the 3100

Data Display:

The 3100 uses a two-line, 20 character-wide LCD screen on the front panel and a four-line, 20-character display on the hand-held controller.

Expansion Capability:

The 3100 has four expansion slots on the Mother Board for accessory interfaces.

I/O Signals:

During operation, the 3100 sends and receives the following signals:

- Begin/End Desorb output signal
- Start GC/MS and Data System output signal
- Desorb Ready output signal
- GC Ready/Continue input signal
- Purge Permission input signal
- Purge Ready output signal

GC Interface:

The 3100 works with almost all commercially-available GC instruments. It supplies or accepts GC and Data System start and ready signals by way of a software-selectable GC I/O board.

Column Capability:

All commercially-available columns. Systems with columns that have an I.D. of less than 0.53 mm may require the Cryofocusing Module, depending on the systems' configurations.

Method Storage:

Up to 16 methods.

Method Scheduling:

Up to 12 method changes in any sample order on a single automatic cycle with a Tekmar-Dohrmann autosampler

1.6 Safety Precautions

Please read, understand, and follow all the precautions described in this section before you set up, install, or operate the Tekmar 3100 and any of its accessories. Tekmar is not liable for any damage or injury resulting from failure to follow the instructions in this manual or failure to exercise appropriate care and caution in the installation, operation, checking, and adjustment of the equipment described in this User Manual.

1.6.1 Electrical

The 3100 and accessories (Cryofocusing Module, ALS autosamplers, AQUATek 50, AQUATek 70, etc.) generate hazardous voltage.

WARNING

- **To avoid electrical shock, turn off and unplug the unit before servicing.**
- **Do not operate the unit without protective covers in place.**
- **The three-wire power cord is a safety feature. To avoid electrical shock, plug the power cord into a properly grounded outlet. Do not use an extension cord; the cord can overheat and cause a fire.**

1.6.2 Temperature

The 3100 and accessories contain heaters. The sample heater in the 3100 can be as hot as 420°C when the 3100 is in operation.

WARNING

Sections of the 3100 and accessories are heated during operation. If you touch a heater, you will be burned. Do not touch the heaters.

CAUTION

Some Tekmar accessories require the use of liquid CO_2 or LN_2. These chemicals produce very low temperatures that can damage human tissue. Avoid touching the chemicals or the surfaces that they cool.

CAUTION

Do not exceed maximum pressure ratings for the 3100 or accessories.

1.6.3 Delivery Pressure

The Cryofocusing Module uses liquid nitrogen coolant.

CAUTION

If coolant delivery pressure exceeds 75 psig, a relief valve on the cryogenic valve assembly will vent the excess pressure.

WARNING

TURBOCool requires a SUPPLY of high pressure liquid $C0_2$. Do not allow the SUPPLY pressure to exceed 1000 psi.

1.6.4 Miscellaneous

WARNING

To avoid any type of interference with the 3100 operation, maintain at least two inches of unobstructed space around the 3100. Move all other equipment outside the two-inch perimeter. The 3100 requires a clear surface area of at least 20" (51cm) deep and 15" (38 cm) wide, with no shelves or overhanging obstructions above. The surface must be able to support at least 40 pounds.

CAUTION

Keep the 3100 away from corrosive gasses, liquids or solids. Corrosive substances will damage outside surfaces and the parts inside.

CAUTION

Operate TURBOCool in a well ventilated area to prevent saturation of the ambient air with carbon dioxide.

GETTING STARTED

Chapter 2

2.1 Overview

This section describes:

- The prerequisites and site preparation for a 3100 installation.
- Unpacking and checking your 3100 shipment.
- The major components of the 3100.

Equipment installation and operation will be easier if you use the illustrations to identify and locate the described components on the 3100.

2.2 Getting Ready for Installation

Please read the instructions in this section before you begin to install the 3100. If you have any questions about site requirements for installing and operating the 3100, please call the Tekmar-Dohrmann Service Department at (800) 874-2004.

2.2.1 Operating Environment

The 3100 operates at temperatures between 19°C to 60°C with humidity levels between 10% and 90%. Generally speaking, an environment with temperature and humidity that are reasonably constant and comfortable for an operator is an environment in which the concentrator will perform reliably.

⚠ CAUTION

Keep the concentrator away from corrosive substances -gas, liquid, or solid - to avoid material and/or component damage.

The 3100 requires a clear surface area at least 18" (46 cm) deep and 15" (38 cm) wide, with no shelves or overhanging obstructions above. The surface must be able to support at least 40 pounds.

⚠ WARNING

To avoid any type of interference with 3100 operation, maintain at least two inches of unobstructed space around the unit. Move all otherequipment outside the two-inch perimeter.

2.2.2 Power Requirements

After selecting and clearing a location for the concentrator, check the availability of the required grounded outlets. The 3100 uses 115V/230V (± 10%) power at 50/60 (±1%) Hz, with one grounded, three-pronged receptacle for the main power cord. Each additional accessory you plan to use may also require one or more grounded outlets.

2.2.3 Gas Supply Requirements

Concentrator operation requires the availability of ultra-high purity helium (as purge gas). Check the following items:

1. Helium purity must be 99.999%, 0.5% hydrocarbon tested.
2. Gas pressure at the source must be high enough to:
   - Allow at least 20 psi pressure drop at every flow or pressure regulator.
   - Travel the distance from the source to the concentrator.
   - Provide the required gas pressure at the concentrator. Operation of the 3100 requires helium at an incoming (supply) pressure of 20 to 60 psig.
3. Gas supply tubing diameter depends on the maximum pressure drop allowable for your setup. If the helium supply is close to the concentrator, you may use ⅛" diameter tubing. However, you may want to use larger diameter supply lines, typically ¼", to reduce pressure drop under the following circumstances:
   - The gas supply is a long way from the concentrator.
   - A single source supplies several instruments.
   - A single source will be subjected to high demand for gas.
4. Gas supply tubing lengths must be adequate. Be generous when cutting lengths of tubing for local supply lines; a relatively long coil of tubing between the supply and the 3100 allows you to move the instrument (to reach rear cover panels, for example) without disconnecting the plumbing.
5. Gas line fittings and regulators must be the correct size and type. Consult your local gas supplier for type and size of cylinder valves; then select compatible pressure regulators based on the required valves. Keep these considerations in mind:

- To reduce high source pressures to the pressure required by the concentrator, use high-quality pressure regulators with stainless steel diaphragms. Tekmar-Dohrmann recommends using a single, two-stage regulator, rather than two single-stage pressure regulators to meet the concentrator's pressure specification.
- On/off valves, while not essential, are very useful when mounted on the outlet fitting of a two-stage regulator.
- Avoid pipe thread connections in your gas supply lines. If you must use them, seal them with instrument-grade Teflon® tape.

CAUTION

Always use instrument-grade Teflon® tape to seal thread connections. Do not use pipe dope or lower grades of Teflon® tape; volatile materials in the dope and/or low-grade tape will contaminate the tubing.

2.3 Unpacking the Concentrator

Please read the instructions in this section before you begin to set up the 3100. If you have any questions about the set up, please call the Tekmar-Dohrmann Service Department at (800) 874-2004.

CAUTION

Failure to follow these instructions may void your warranty for components damaged in shipment.

1. Remove the 3100 kit box and the concentrator from the shipping carton. Each concentrator is shipped with a kit box. An optional installation kit with additional parts needed to set up and install the 3100 is available from Tekmar-Dohrmann (P/N 14-5092-100).
2. Compare the contents of the kit box and/or installation kit against the packing list that accompanies your shipment. Check for each listed item.
   - If an item is missing, call the Tekmar-Dohrmann Customer Service Department toll-free at (800) 543-4461; outside the US and Canada, call (513) 247-7000.
   - If any shipped item is damaged, immediately notify the shipping carrier and the Tekmar-Dohrmann Customer Service Department of its condition.

3. Examine the concentrator carefully. If it is damaged, notify the shipping carrier and Tekmar-Dohrmann immediately. Do not continue installation until a Tekmar-Dohrmann representative authorizes you to do so.
4. Save all shipping materials until you verify that the instrument operates correctly.
5. Do not return the concentrator unless authorized to do so by a Tekmar-Dohrmann representative.

WARNING

For the safety of everyone concerned, Tekmar-Dohrmann will not service returned instruments that are shipped with needles or any other sharp objects installed on their exteriors; Tekmar-Dohrmann will promptly return these instruments to customers.

This policy mainly applies to returned purge and trap autosamplers, which are shipped with stainless steel needles or glass dip tubes installed.

To receive prompt, reliable service, and reduce the risk of injury, please remove all sharp objects from the exterior of any Tekmar-Dohrrmann instrument before shipping.

2.4 Major Components

The 3100 (Figure 1-1) consists of a concentrator with a front-panel sample glassware assembly and an optional hand-held controller.

2.4.1 Hand-held Controller

The hand-held controller is a four-line, 20-character wide, LCD (liquid crystal display) and a keypad. The display consists of data entry screens for programming and entering data, menu and action screens for selecting options and commands, and status screens for viewing during operation.

2.4.2 Front Panel Display

The front-panel display provides status information during concentrator operation.

- The Trap Pressure gauge shows the current sample gas pressure (in psig).
- The LCD screen displays information about the concentrator's current operating step. The first line displays the step name, the number of the currently active method (or operating sequence), and the number for the position of the currently active sample. The bottom line displays the current reading for the most significant operating step parameter.

2.4.3 Front Panel Glassware

The front panel holds a single sample sparger assembly, as illustrated in Figure 2-1.

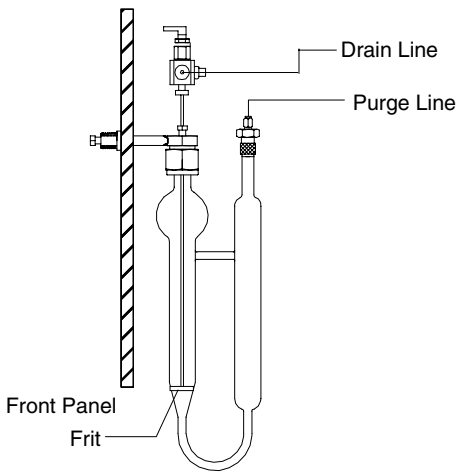


Figure 2-1 Sample Glassware Assembly

The 3100 can accommodate a 5 ml or 25 ml sample sparger. The sampler mount is attached to the front panel; the sample valve assembly and the glassware are shipped separately for you to attach when you set up the 3100.

2.4.4 Concentrator Trap

Figure 2-2 shows a partial right side view of the Tekmar 3100 with the outer panels cut away to show the trap and the electronic components.

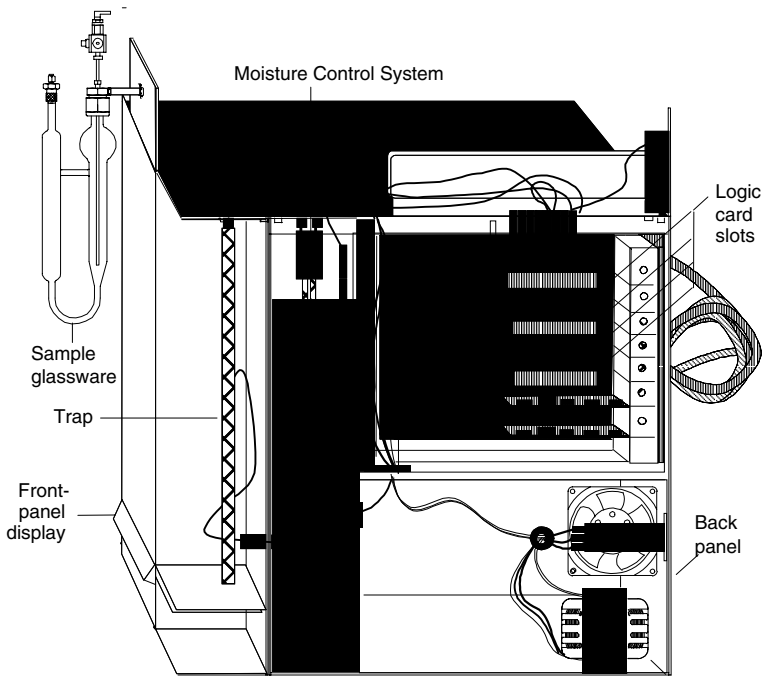


Figure 2-2 Tekmar 3100 (Right Side)

2.4.5 Electronic Components

The 3100's right compartment holds the 12-inch long, 1/8" diameter, sorbent-packed trap.The 3100 ships with a blank #0 trap which needs to be replaced with the appropriate packed trap. Analytes in the sample stream coming from the sparger are adsorbed onto the packing material.

Concentrator operations are controlled by a group of logic cards mounted in the rear half of the 3100 (see Figure 2-3). The main logic card holding the controlling ROM (read-only memory) chips is in the bottom slot. The board in the top slot uses thermocouples to read temperatures. The other five slots accommodate logic cards that make it possible for the Tekmar 3100 to communicate with a personal computer and to operate with one or more autosamplers or other accessories.

2.5 Gas Inlets and Outlets

Figure 2-3 illustrates the concentrator's rear panel, showing the gas inlets for sample/purge and carrier gas.

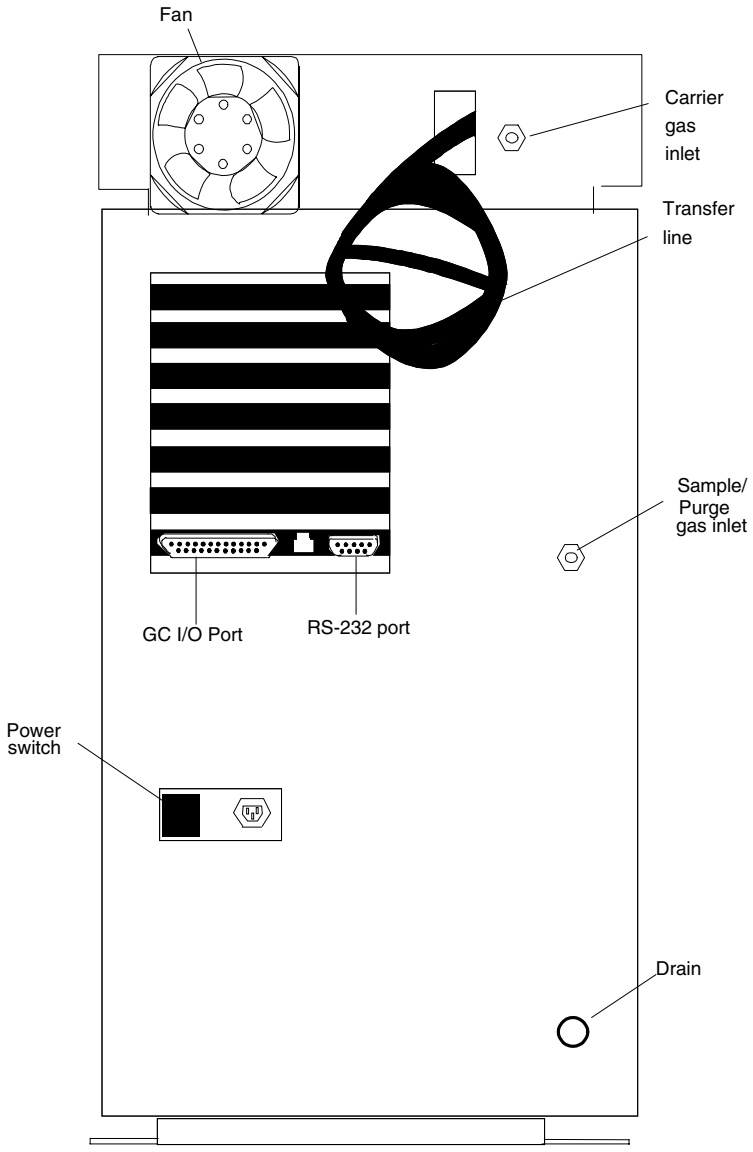


Figure 2-3 Tekmar 3100 Rear Panel

2.5.1 Sample/Purge Gas Inlet

Sample gas (ultra-high purity helium) flows through the sparger to carry organic analytes onto the trap. (Nitrogen can be used as sample gas, but it may contain more impurities.) The helium or nitrogen enters the back panel at the opening labeled “Sample”.

Depending on the concentrator’s operating mode, sample gas flows through the sample sparger (to carry analytes to the trap), or it bypasses the sparger to circulate in a passive circuit and flows out the front panel vent.

Tekmar-Dohrmann recommends a sample gas flow of 35 ml/min ± 5 ml for 11 minutes to achieve a 385 ml purge volume.

2.5.2 Carrier Gas Inlet

Carrier gas is high purity helium (or nitrogen) used to desorb volatile analytes off the internal trap and carry them through the transfer line back to the GC. Carrier gas enters the back panel at the opening labeled “Carrier”. Depending on the concentrator’s current operating mode, carrier gas flows through the trap and carries volatile analytes over to the GC, or it makes a passive circuit through the concentrator and returns, unchanged, to the GC through the transfer line.

2.6 3100 Valves and Lines

The valves visible from the top of the unit are:

- Two adjustable regulating valves near the back of the 3100. They control the sample pressure and sample flow of gas entering the 3100 through the sample gas inlet.
- The sample and bypass valves. Sample gas flows from the flow controller to the sample valve. When the sample valve is closed, sample gas flow is cut off. An open sample valve directs flow to the bypass valve, which routes it either to the sample sparger or to the sample tee.
- The sample tee accepts flow from the sample sparger or from the bypass valve and directs it to the six-port valve.
- The six-port valve inside the valve oven has two settings that control the direction of sample and carrier gas flow through the concentrator.
- The trap pressure control (TPC) valve controls back pressure on the concentrator trap.

2.7 Autosamplers

- The 3100 can work with the ALS 2016/2032 to process up to 32 liquid and/or soil samples.
- The 3100 can work with the AQUATek 50 vial autosampler to process up to 50 drinking and wastewater samples.
- The 3100 can process up to 65 drinking and wastewater samples with the 2016 and AQUATek 50 (up to 15 on the 2016 and up to 50 on the AQUATek 50).
- The 3100 can work with the AEROTrap 6016/6032 to process up to 32 air samples.
- The 3100 can process up to 16 air samples (with the AEROTrap 6016) or up to 16 liquid and soil samples (with the AEROTrap 6032 and the ALS 2016).
- The 3100 can process up to 70 liquid samples with the AQUATek 70.

2.8 Cryofocusing Module

For further instructions, see the manuals shipped with the autosamplers.

If you plan to run samples that contain highly volatile components on a small bore capillary column, Tekmar recommends using a Cryofocusing Module (available as a separate purchase) with the 3100. For more information, see the manual shipped with the Cryofocusing Module.

2.9 TURBOCool

TURBOCool is an optional accessory to the 3100. The TURBOCool accessory keeps the trap at a uniform temperature and permits purging onto a subambient* trap. This minimizes breakthrough and improves resolution of the lighter, early eluting gases in gas chromatography.

* temperature that is lower than the surrounding air

2.10 TekLink

TekLink software makes it possible for you to use a personal computer (PC) running Microsoft® Windows™ to monitor, schedule and control the operation of one, two, three or four concentrators. Using TekLink, you can:

- define custom methods or operating sequences that meet your analytical requirements.
- set up schedules for running certain methods at specified positions on an autosampler.
- start, interrupt and/or reset a run in progress.

3100 SETUP

Chapter 3

3.1 Overview

This section provides instructions for the following:

- Connecting the Tekmar 3100 to the GC (electronically and pneumatically)
- Installing accessories
- Leak checking the installation

3.2 Making Pneumatic Connections

The 3100 requires two independent gas flows:

- Carrier gas flows from the GC to the carrier gas inlet on the 3100, through the 3100, and back to the GC by way of a heated transfer line.
- Sample gas flows from the sample gas source to the 3100 sample inlet, through the sparger, over the trap, and out the 3100 vent.

You may use a single gas supply as the source for both sample and carrier gas; however, the flows must be independent of each other. Figure 3-1 illustrates a GC connected to a carrier gas supply. You can tap into the carrier gas supply line to provide carrier and sample gas for the 3100.

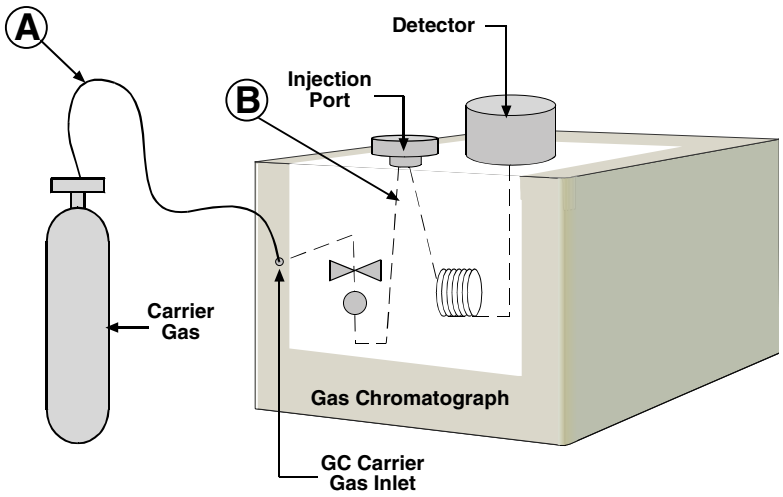


Figure 3-1 Gas Chromatograph Connections

The following sections tell you how to connect the 3100 and the GC pneumatically:

- To provide sample gas to the 3100, tee off the supply line at point A (Figure 3-1). Follow the instructions in the next section.
- To provide carrier gas flow and connect the 3100 to the GC, cut the gas supply line at point B (Figure 3-1) to divert carrier gas flow through the 3100 and back to the GC via the 3100 transfer line.

3.2.1 Connecting the Sample Gas Line

Sample gas is usually supplied through a tee union from the GC carrier gas supply tank.

1. If there is no tee union in the carrier gas supply line to the GC, install one (as illustrated in Figure 3-2).
2. Run the sample gas line from the tee to the fitting marked "Sample" on the concentrator's rear panel.

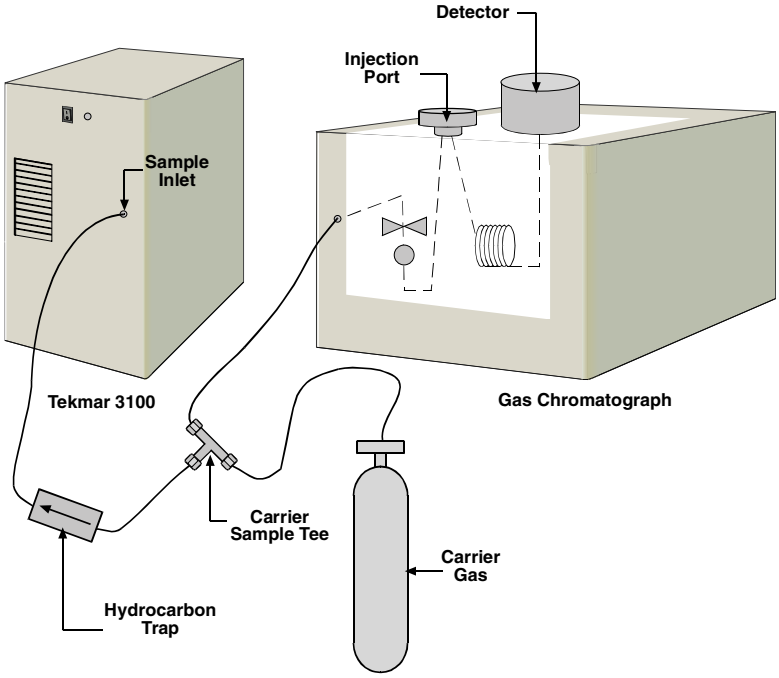


Figure 3-2 Connecting to a Sample Gas Supply

Note: If there is no hydrocarbon trap on the carrier gas supply, install the trap provided in the 3100 kit box, as shown in Figure 3-2.

3.2.2 Connecting to the GC and Carrier Gas Supply

When you connect the 3100 to the gas chromatograph, you can:

- Make a direct column connection (using an optional Cryofocusing Module, if desired), or
- Connect to the GC carrier gas inlet and leave the injection port free for direct injections.
- Connect to the GC carrier gas inlet using a Low Volume Insert in the GC injection port. Call Tekmar-Dohrmann at 1-(800) 543-4461 for details.

Note: If you plan to use a Cryofocusing Module, you must make a direct column connection to the GC.

3.2.2.1 Using GC Regulated Carrier Gas

When you make the connections illustrated in Figure 3-3, the GC supplies and controls carrier gas flow to the 3100. Using this configuration keeps the GC injection port free for direct sample injections. You cannot use a Cryofocusing Module with the configuration shown in Figure 3-3.

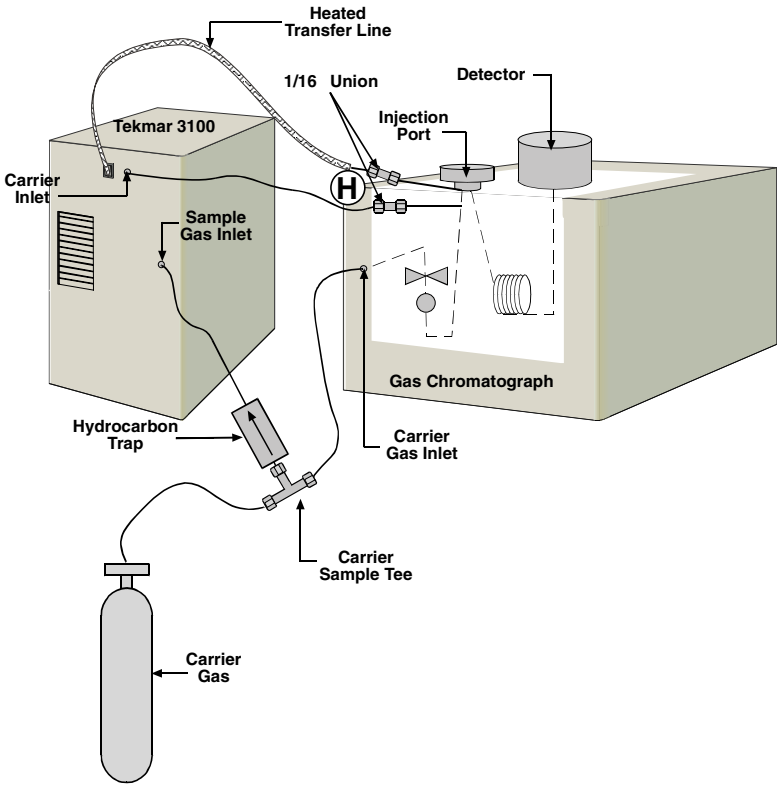


Figure 3-3 GC-Regulated Carrier Gas Connections

To make the connections:

1. Make sure the GC is not hot; allow it to cool to room temperature.
2. Select an injection port. You may have to remove the covers around the port to expose the stainless steel line which supplies carrier gas to the port.

CAUTION

Some injection ports have multiple pieces of tubing connecting to the injection port. Do not cut any lines unless you are sure which is the carrier line.

3. Open the line at a point one or two inches from the injector housing (point H in Figure 3-3). If a union connects tubing from the carrier gas supply to the stainless steel injector port inlet, disconnect the union. If there is no union, cut the line.
4. Connect the line coming from the GC control pneumatics to a 1/16" union.
5. Connect a piece of 1/16" nickel tubing to the union; connect the other end to the union labeled "carrier" on the back of the 3100.
6. Connect the tubing to the injection port inlet (at point F of Figure 3-4 on the following page) using a 1/16" Swagelok union.

Note: You may need to secure the center of the union to the column cage to relieve any stress caused by the weight of the union. If the injection port is split/splitless, you must cap the split vent and septum purge. Some applications require you to use the split. If this is the case, the split vent and septum purge should remain open.

3.2.2.2 Making a Direct Column Connection Using an External Regulator Assembly

You must use an external pressure regulator (EPR) when the back pressure in the GC's injection port is regulated on the downstream side. The following systems require an EPR:

- Any Hewlett Packard GC that has a 0.2, 0.25, or 0.32 capillary column and a Cryofocusing Module installed.
- Any Varian GC that has a 1077 injector (split/spitless) with a 0.2, 0.25, or 0.32 column and a Cryofocusing Module installed.

Figure 3-4 shows the connections required to make a direct column connection to the GC.

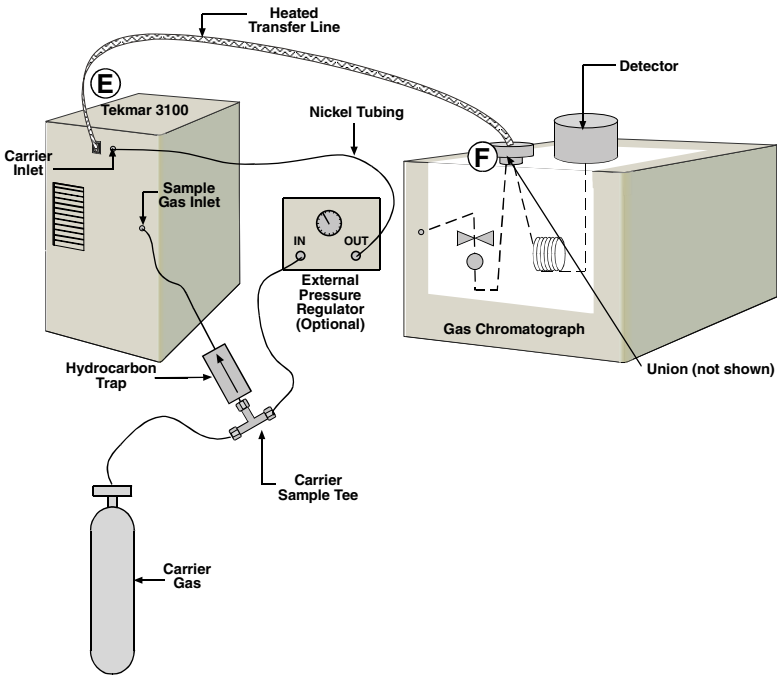


Figure 3-4 Direct Column Connections to the GC

To make a direct column connection:

1. Make sure the GC is not hot; allow it to cool down to room temperature.
2. Since this configuration removes carrier gas flow from the GC pneumatic control, you must install an external pressure regulator (Tekmar-Dohrmann P/N 14-3938-000, or equal) between the gas supply source and the carrier gas inlet to the 3100.
   - Disconnect the carrier gas line from the GC and run it to the inlet of the external pressure regulator.
   - Connect the outlet of the regulator to the carrier gas inlet on the 3100 rear panel at point E (see Figure 3-4).
3. Find an opening in the GC to route the transfer line into the GC oven to make the connection to the column (i.e. unused injection port or detector).
4. Using a zero dead volume union, connect the column to the transfer line from the 3100 at point F (see Figure 3-4).

Notes:

1. If you use the Tekmar 3100 with a Cryofocusing Module, connect the transfer line to the Cryofocusing Module, not directly to the GC. Please refer to the Cryofocusing Module Instruction Manual for installation instructions.

2. Be sure that the line heater assembly on the transfer line is as close to the injection port as possible to minimize cold spots. As an alternative, the transfer line can pass through the injection port with the union in the GC oven.

3.3 Setting Sample Pressure

1. Turn on the 3100 by pressing the power switch on the rear panel.
2. Press ENTER to clear the Start-Up screen. The 3100 performs self tests and goes to Standby.
3. Make sure that Standby Flow is defaulted to ON.
4. Remove the top cover to expose the Sample Pressure, Trap Pressure Control (TPC) and Sample Flow controllers on the top left hand side. To avoid electrical shock, do not touch any internal parts except the control knobs.
5. Press and hold SHIFT while you press GO TO.
6. Press <B> Manual Operation.
7. Press <B> Feed Pressure. This closes the vent valve. You will see a lashing P on the display while feed pressure is on.
8. Set the sample gas pressure to 20 psi using the knob marked "Sample Pressure". Read the pressure on the front panel gauge.

3.4 Setting Trap Pressure Control (TPC)

The trap pressure control (TPC) valve is factory set at 4 psi. However, you can change the setting. To do so:

1. Make sure Standby Flow is defaulted to ON.
2. If there is a flashing P, Feed Pressure is on. Turn it off by pressing SHIFT-GOTO, then <B> (Manual Operation), and then <B>, (Feed Pressure). The flashing P should now be off.
3. Using the knob marked "Trap Pressure Control (TPC)", set the system back pressure. Do not set the pressure of the TPC valve equal to or higher than the GC column head pressure.

3.5 Setting Sample Gas Flow

1. Make sure Standby Flow is defaulted to ON.
2. Attach a flow meter to the vent fitting on the left front panel of the 3100 to measure the flow rate of the sample gas.
3. Set the sample gas flow to 35-40 ml/min using the knob marked "Sample Flow".

Note: Anytime you adjust TPC or sample gas pressure, you must recheck the sample gas flow; they are interdependent.

3.6 Installing the Drain Tubing

To install a drain tube for the Tekmar 3100:

1. Attach a length of 1/8" I.D. plastic tubing to the fitting marked "Drain" on the back of the concentrator.
2. Run the drain tube to a sink or waste bottle.

3.7 Making Electronic Connections

If you are using an accessory like an autosampler or a Cryofocusing Module, it must be connected electronically to the 3100 by way of a cable. This cable extends from a port on the accessory to a logic I/O card in the 3100. The 3100 must also be connected electronically to the GC.

3.7.1 Installing Logic Cards

You must install a logic I/O card in one of the 3100's logic card slots for each accessory that you connect to the 3100.

To access the logic card slots in the 3100:

1. Turn off and unplug the 3100.
2. Loosen the two 1/4 turn screws on the front of the panel.
3. Slide the panel forward and then to the right to remove it.
4. Slide the top panel forward. Then lift it up.
5. Remove the screw holding the top of the right side panel.
6. Lift the right side panel away from the 3100 to expose the logic card slots.

To install a logic card:

1. Loosen the screw on one of the unused card slot covers. Remove the cover.
2. Insert the logic card into the open card slot. Push it in until the back of the board is flush with the other card slot covers and the card seats in the connector.
3. Tighten the screw on the board to secure it.

3.7.2 Connecting to Accessories (Electronically)

With each accessory, you received an interface cable as well as a logic card. To connect an accessory to the 3100:

1. Insert one end of the cable into the port of the appropriate logic card on the 3100.
2. Connect the other end of the cable to the logic card connector in the accessory, following the installation instructions for the accessory.

3.7.3 Connecting to the GC (Electronically)

The 3100 comes with a GC interface card installed, as shown in the view of the 3100 rear panel in Figure 3-5.

Instructions for connecting a 3100 to a specific model of gas chromatograph accompany the interface cable required for your specific 3100-to-GC setup.

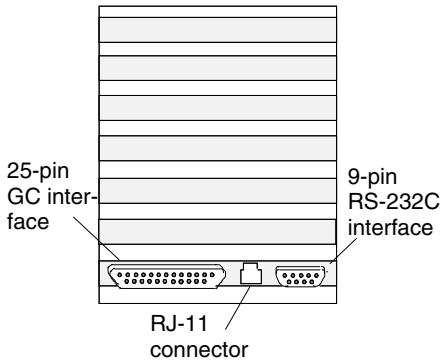


Figure 3-5 GC Interface Card

3.8 Leak Checking Guidelines

WARNING

To leak check, you must remove the 3100's panels. To avoid electrical shock, do not touch any internal parts except the control knobs. Before you leak check, remove jewelry; it conducts electricity.

To ensure accurate, reproducible results from analytical runs with the 3100, check fittings (pneumatic connections) for leaks. Follow these guidelines when you leak check your 3100 installation:

- Leak check after you have completely assembled the system and made all pneumatic connections.
- Use an electronic thermal conductivity detector (such as a Tekmar-Dohrmann Gas Leak Detector, P/N 21-0052-000) to check the fittings.
- Use helium (not nitrogen) as the pressurizing gas. (Electronic leak detectors do not reliably detect nitrogen.)
- If an electronic leak detector is not available, you may use a 1:1 solution of isopropanol and water. Use the solution sparingly to avoid contamination.
- Allow the 3100 to warm up for a least thirty minutes before you leak check. The fittings need time to reach operating temperature and expand; otherwise, they will leak.

CAUTION

- **Do not use any type of soap solution (for example, Snoop or Detect) to check for leaks. If soap gets into the lines, it will cause background and adsorption.**
- **If you tighten fittings before the 3100 has pressurized and warmed to operating temperature (30 mins.), you could damage the ferrules by overtightening the nuts. You could also strip the threads on the nuts and not be able to remove them.**
- **If you find a leak, finger-tighten the nut, then turn 1/4-turn with a wrench. Recheck. If it still leaks, look for other possible causes; do not over-tighten. Leaks can also be caused by a crack in the line or a damaged nut or ferrule. Also, a part may be of incorrect size or material. If a leak problem persists, call Tekmar-Dohrmann Service.**

3.8.1 Leak Checking

To check for leaks in the sample gas flow lines:

1. Follow the instructions in Section 3.3, Setting Sample Pressure.
2. Attach a flow meter to the vent fitting on the left front panel of the 3100 to measure the flow rate of the sample gas.
3. Use the knob marked "Sample Flow" to set the sample gas flow to 35 - 40 ml/minute.
4. Put 5 ml of organic-free water in the purge vessel.
5. Do one of the following:
   a. Put a 1/16" cap nut on the 3100 vent fitting on the front panel. Tighten the fitting wrench-tight OR
   b. If you have ROM (read-only memory) version 2.10 or greater, you can use the software's Leak Check feature to cap the vent. This feature causes the sample valve to open and the vent valve to close. To start Leak Check, press SHIFT-GOTO, then the B key. Next, choose option C. A flashing "L" on the display indicates that Leak Check is on.
6. Time the bubbling in the purge vessel. If the bubbling stops between three to 14 minutes, the system is leak tight; no further leak checking is necessary.

To diagnose a leak:

1. Make sure the leak is not at the capped vent. The Swagelok nut may be worn.
2. If the bubbling stops before three minutes have elapsed, it is likely that there is a leak upstream of the purge vessel (before the gas flow reaches the purge vessel). If a leak is indicated, leave the system in purge with the vent capped. Capping the vent causes pressure to increase, which exaggerates the leak and makes it easier to find.
3. If the bubbling continues after 14 minutes, a leak exists downstream of the purge vessel (after the gas flow leaves the purge vessel).
4. Using an electronic leak detector, check the fittings at the top and bottom of the trap.
5. Check the fittings inside the valve oven of the 3100.
6. Check these five fittings around the glassware on the front of the 3100:
    a. Purge line fitting (at glassware)
    b. Purge bulkhead (at the 3100)
    c. Sample glassware fitting
    d. Sample needle nut
    e. Sample valve (three-port)
7. Check the Swagelok fittings inside the 3100.

After you have installed the 3100 and made all pneumatic connections, the GC column back pressure gauge should show the same reading as before.

- If the gauge reading is higher that its pre-installtion level, check the lines for clogs.
- If the gauge reading is lower than its pre-installation level, there is a leak. Check fittings with a leak detector; tighten as necessary.

UNDERSTANDING OPERATING STEPS

Chapter 4

4.1 Overview

An analytical run on the Tekmar 3100 consists of a programmed sequence of steps, called a method.

This section performs the following functions:

- Describes the operating steps used by the 3100 in various analytical configurations and defines the default values assigned to parameters in each step.
- Tells you which parameters you can program to create customized methods.

4.2 Steps in an Operating Sequence

Depending on the system configuration and installed accessories, the 3100 goes through a programmed sequence of operating steps. Table 4-1 lists the operating steps in order of their occurrence. If an operating step is active only under certain conditions (with a specific system configuration or when a specific accessory is installed), the second column in the table defines the conditions. The third column in the table describes each step.

Step	When Present	Purpose
Standby	All configurations	The main preparatory step for each run; it establishes initial conditions on power up, restart, or after a run. When the 3100 powers up or returns to its starting conditions after a run, this step is active. Press START to begin a run.
GC Synchronize	All configurations	Adds enough time to the 3100 operating cycle to synchron-ize it with the GC cycle. When the 3100 is connected to an autosampler and running multiple samples, this step replaces Purge Ready between samples.
Turbo Cooldown	With TURBOCool accessory installed	Cools the trap to its low temperature setpoint for trapping analytes.
Purge Ready	All configurations	Waits for a start signal from the user (via the START key on the keypad) or from an accessory before proceeding to the next step. The Purge Ready screen displays the message “Press start to begin" and the number of the current method.
Sample Fill	With Tekmar autosampler installed	Opens the vent valve in the 3100 to allow sample transfer from the AQUATek 50 to the 3100 or to the 2016/2032 autosampler.
Prepurge	With sample heater installed and activated	Sends gas flow through the sample glassware to remove oxygen and to blanket the sample with inert gas. The inert gas prevents oxidation during the Purge step.
Preheat	With sample heater installed and activated	Heats the sample before the Purge step.
Purge	All configurations	Flushes the sample with purge gas for a specified length of time.
Dry Purge	All configurations	Sweeps dry gas through the 3100 trap to remove moisture.
MCS Cooldown	All configurations	Cools the Moisture Control System to its Desorb setpoint before desorption.
Desorb Ready	All configurations	During this step, the concentrator sends a DESORB READY signal to the GC and waits for the GC READY signal.
Cryo Cooldown	With Cryofocusing Module installed	Cools the Cryofocusing Module to its low temperature setpoint for trapping analytes before desorption onto the column.
Desorb Preheat	All configurations	Heats the concentrator trap to a specified preheat temperature before desorbing the analytes.
Desorb	All configurations	Backflushes the analytes off the heated concentrator trap onto the Cryofocusing Module (if present) or directly onto the GC and gives the GC a START signal.
Inject	With Cryofocusing Module installed	Transfers the sample from the Cryofocusing Module to the GC. Used only if a Cryofocusing Module is installed.
Bake	All configurations	Turns the MCS and the concentrator trap heaters up to Bake temperatures, turns on the sample bypass and vent valves, and sends clean gas through the unit to sweep residual moisture and organic contaminants from the lines.

Table 4-1 Tekmar 3100 Operating Steps

4.3 Operating Cycle Time

Operating cycle time is important for system configurations in which a TurboCool accessory is installed. Figure 4-1 illustrates relative operating cycles for the 3100 and the GC. Each unit has a fixed cycle time, or number of minutes required to complete an operating sequence.

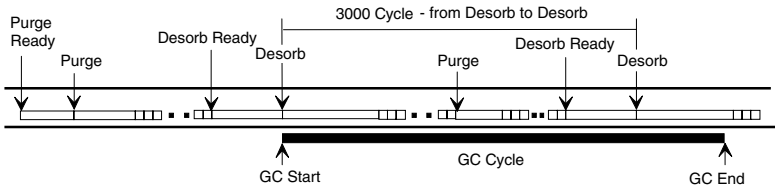


Figure 4-1 GC and 3100 Cycle Times

If the time from GC Start to GC End (including time for the GC to cool down) is longer than the uninterrupted 3100 cycle time from Desorb to Desorb, the 3100 waits in Desorb Ready until it receives a GC READY signal from the GC. To minimize the length of time in Desorb Ready (and reduce cryogenic usage), a GC Synchronize step is added between samples for all multiple sample runs, as illustrated in Figure 4-2.

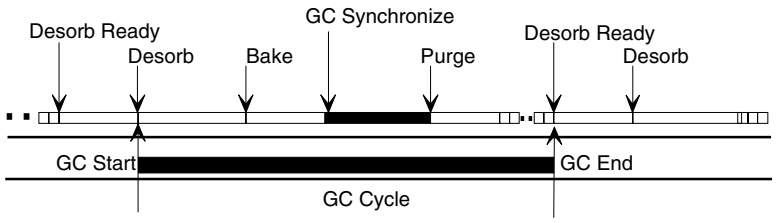


Figure 4-2 Synchronizing 3100 and GC Cycle Times

4.4 Operating Step Parameters

Purge and trap operations are controlled by valve configurations that determine gas pressure and flow for carrier gas and sample gas. Figure 4-3 shows the drain lines, vent lines, and flow paths for carrier gas and sample gas in the 3100.

4.4.1 Valve Settings

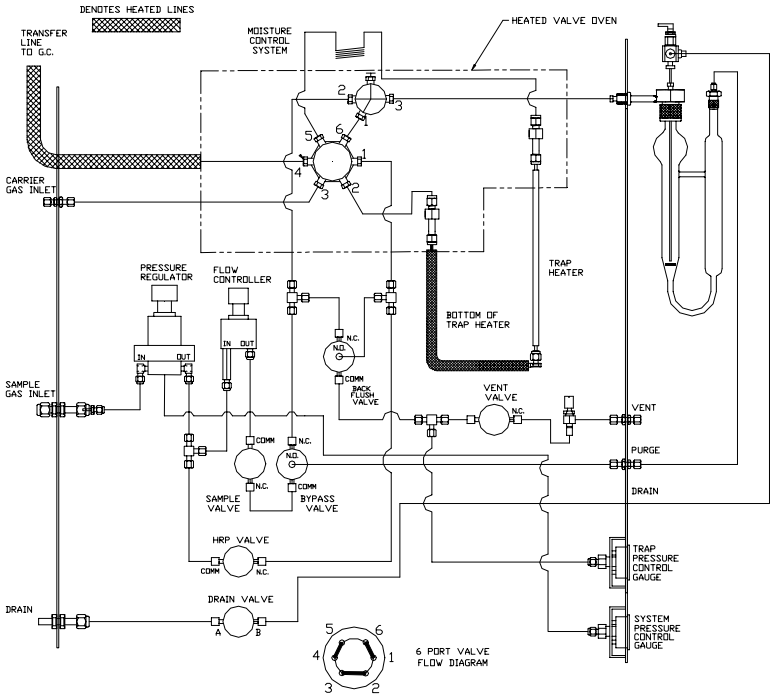


Figure 4-3 3100 Flow Paths

4.4.1.1 Sample Valve

The flow controller and pressure regulator control the flow rate and pressure of the gas coming into the 3100. Gas flows to the normally closed sample valve. If Standby flow is turned on through the software, gas flows through the sample valve during Standby, Purge Ready, Purge, Desorb Ready, Desorb with Drain and Bake. If Standby flow is turned off, gas flows through the sample valve during Purge, Dry Purge and Bake. Also, when you use Desorb without the drain, the sample valve is closed.

4.4.1.2 Bypass Valve

When the sample valve is open, sample gas flows to the three-way bypass valve. During the Standby, Purge Ready, Dry Purge, and Bake (with Bake Gas Bypass) steps, the bypass valve directs flow from the sample valve to the sample tee, bypassing the sample glassware. During the Purge, Desorb Ready, Desorb Preheat, Desorb, Desorb with Drain, and Bake steps, the bypass valve directs flow from the sample valve to the sample glassware on the front panel of the 3100.

4.4.1.3 Drain Valve

The drain valve opens to allow liquid to flow from the sample glassware to exit at the 3100 drain at the rear of the concentrator.

4.4.1.4 HRP Valve

The high rate purge (HRP) valve is normally closed. It works with the drain valve. When the HRP and drain valves are open during the Desorb step (when autodrain is on), incoming sample gas is split, allowing flow to pressurize the sample glassware and force liquid up through the needle, out of the glassware through the drain on the rear of the 3100.

4.4.1.5 Vent Valve

The vent valve opens to allow pass-through flow during the Standby, Purge Ready, Purge, Dry Purge, Bake, and Bake with Bake Gas Bypass steps. When it is open, gas flows through the sample pathway and out the vent on the front of the 3100.

4.4.1.6 Backflush Valve

The backflush valve opens to allow pass through flow across the trap during Bake.

4.4.1.7 Six-Port Valve

The six-port valve (located inside the valve oven) has two positions that control the direction of sample and carrier gas flow through the concentrator. The concentrator operates with two separate gas flows:

- Sample gas enters through the sample gas inlet at the back of the unit and exits through the front panel vent valve.
- Carrier gas enters through the carrier gas inlet at the back of the unit and proceeds through the transfer line to the gas chromatograph.

The six-port valve controls the route traveled by the sample and carrier gas during each step in the operating sequence. Figure 4-4 shows the initial six-port valve setting, called the Standby configuration.

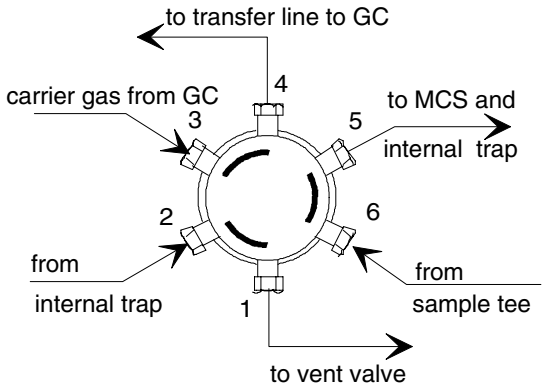


Figure 4-4 Six-port Valve Standby Setting

The Standby configuration for the six-port valve is in effect during all operating steps except Desorb (with or without drain). In Standby:

- Carrier gas enters the six-port valve and exits immediately through the transfer line to the gas chromatograph.
- Sample gas enters the six-port valve from the sample tee and flows over to the trap; from the trap it returns to the six-port valve and exits out the vent valve.

Figure 4-5 depicts the six-port valve Desorb configuration.This configuration is in effect during Desorb. Carrier gas enters the six-port valve and flows over to the bottom-of-the-trap area, backflushes the trap, returns to the six-port valve, and exits through the transfer line to the gas chromatograph.

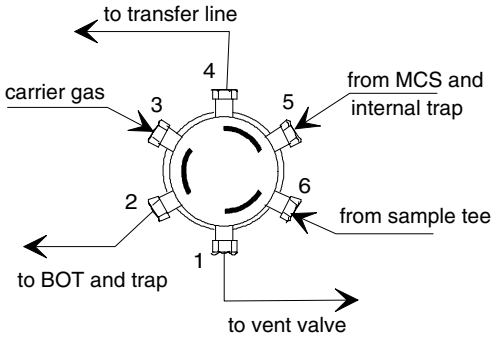


Figure 4-5. Six-port Valve Desorb Setting

4.4.1.8 Trap Pressure Control Valve

The trap pressure control (TPC) valve is a needle valve located between the vent valve and the front panel vent opening. The TPC valve regulates back pressure on the trap. Increasing pressure on the trap shifts the partitioning of

volatile analytes between the vapor phase and stationary phase, allowing the analytes to have increased interaction with the adsorbent. They do not travel as far into the adsorbent, and, as a result, are released in a tight band upon desorption. This improves peak shape and sensitivity.

The TPC valve is not under program control; you adjust it manually. At the factory, the TPC valve is set to maintain the recommended back pressure of 4 psi. Do not set the pressure of the TPC valve equal to or higher than the GC column head pressure. As a rule, the difference between the TPC valve and feed pressure settings should be greater than 10 psi. For example, if the feed pressure is 20 psi, set the pressure of the TPC valve less than 10 psi. While TPC valve pressure can be beneficial at the correct level, setting it too high can cause carryover.

4.4.2 Time and Temperature Parameters

An operating step can define the temperature setpoint for heating or cooling and the length of time during which the temperature will be maintained at setpoint. Depending on your system configuration and installed accessory options, you can program methods that specify required time and temperature values for heating and/or cooling the following parts:

- Sample heater on the front panel (optional).
- Six-port valve and tee in the valve oven.
- Transfer line heater from the 3100 to the GC.
- Moisture Control System (MCS) just behind the trap.
- Adsorbent trap during Standby, Desorb, and Bake.
- Bottom-of trap (line from the six-port valve to the bottom of the trap).
- Cryofocusing Module at the injection port of the GC (if used).
- Valve and line temperatures of optional autosampler(s).

4.5 Understanding Operating Steps

4.5.1 Purge Ready

Before beginning a run, the 3100 is in Standby. Standby is active until heated (and/or cooled) parts reach their setpoints.

On the first run in a schedule, this step pauses to wait for a start signal. If the 3100 is operating with an autosampler, the autosampler rotates through sam- ple positions until it reaches the starting position specified in the current operating sequence. Figure 4-6 and Table 4-2 show valve configurations during Standby and Purge Ready.

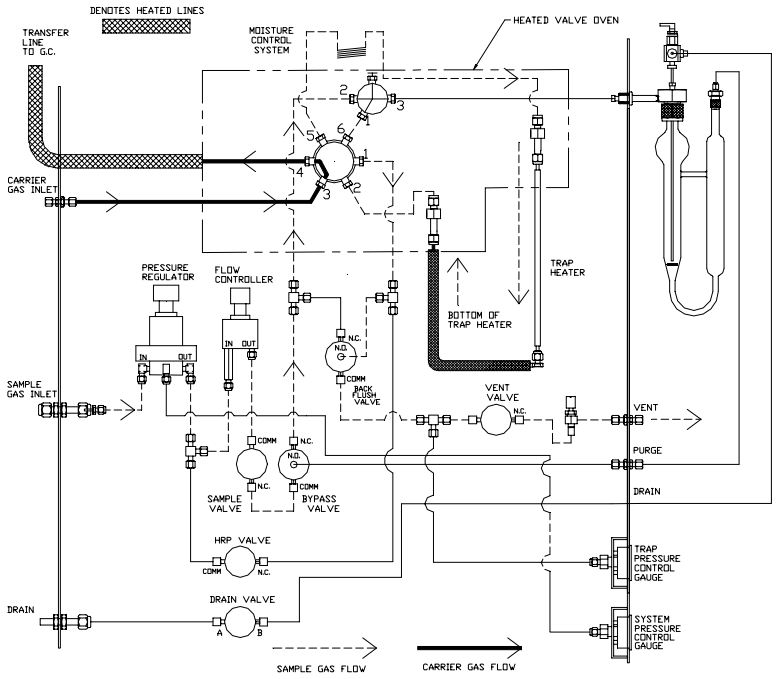


Figure 4-6 Gas Flow during Standby and Purge Ready

Valve Designation:	Sample	Bypass	Vent	HRP	Drain	6-port	Backflush
Position:	open[1]	on[1]	open[1]	closed	closed	Standby	closed

[1] Only if Standby Flow is on.

Table 4-2 Valve Configuration during Standby and Purge Ready

4.5.2 GC Synchronize

If you have installed a TURBOCool accessory, a GC Synchronize step replaces Purge Ready between runs on a multiple sample sequence. During GC Synchronize, the 3100 waits before proceeding to the next step. The 3100 calculates the length of the delay (up to 1000 minutes), based on the GC cycle time parameter. Valve settings during this step do not change.

4.5.3 Sample Fill

If your configuration includes an AQUATek 50 automatic sampler, during the Sample Fill time specified for this step, the sample volume is transfer-red into the sample glassware on the 3100 or on the ALS autosampler. For more information, refer to the AQUATek 50 User Manual.

4.5.4 TURBO Cooldown

If you have installed a TURBOCool accessory, this step cools the TURBO-Cool trap to its low temperature setpoint (TURBOCool Temp).

4.5.5 Prepurge and Preheat

If you installed and turned on a sample heater, the 3100 can operate with Prepurge and Preheat steps. During Prepurge, the bypass valve allows purge gas to flow through the sample glassware for a programmed time (Prepurge Time) before the sample is heated. The flow of gas blankets the sample with inert gas to avoid heat-induced sample oxidation.

4.5.6 Purge

During Preheat, the sample is heated to the programmed sample temperature setpoint (Sample Temp) for a programmed time (Preheat Time). This step should be just long enough to heat the sample to temperature. It is best to avoid long preheat times. There is no Purge flow during Preheat.

During Purge, the sample is purged with sample gas for the time specified in the Purge Time parameter. Table 4-3 and Figure 4-7 show the change in valve configurations for Prepurge and Purge.

Valve Designation:	Sample	Bypass	Vent	HRP	Drain	6-port	Backflush
Position:	open	off	open	closed	closed	Standby	closed

Table 4-3 Valve Configuration during Purge

Gas enters the sample gas inlet, flows through the pressure and flow regulators, through the sample and bypass valves, to the sample glassware.

Analytes are released from the sample. They flow through the sample line and the six-port valve. Then they are adsorbed on the concentrator trap.

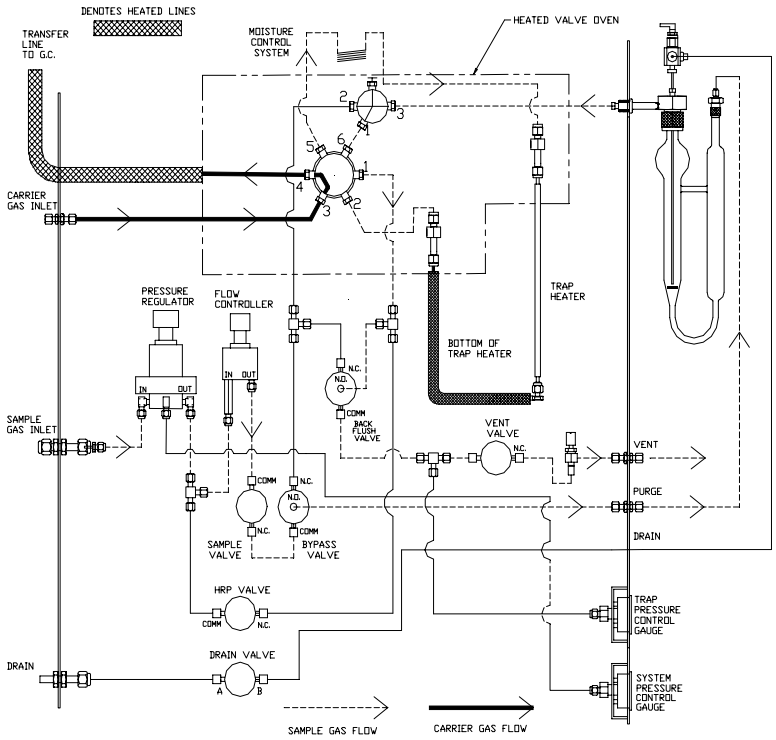


Figure 4-7 Valve Configuration during Prepurge and Purge

4.5.7 Dry Purge

During Dry Purge, the bypass valve closes, as indicated in Table 4-4.

Valve Designation:	Sample	Bypass	Vent	HRP	Drain	6-port	Backflush
Position:	open	on	open	closed	closed	Standby	closed

Table 4-4 Valve Configuration during Dry Purge

Dry Purge sweeps dry gas through the concentrator trap for a programmed time (Dry Purge Time), normally 4 - 6 minutes. If the trap is packed with a hydrophobic adsorbent like Tenax, the flowing gas removes water. If the trap contains silica gel or charcoal, this step does not remove water.

4.5.8 MCS Cooldown

This step cools the MCS (Moisture Control System) to its moisture removal setpoint (MCS Des Temp) for the Desorb step.

4.5.9 Desorb Ready

During Desorb Ready, valve configurations change, as shown in Table 4-5.

Valve Designation:	Sample	Bypass	Vent	HRP	Drain	6-port	Backflush
Position:	closed	off	closed	closed	closed	Standby	closed

Table 4-5 Valve Configuration during Desorb Ready

The 3100 outputs a Desorb Ready signal to the GC and waits for a GC Ready signal in return. There is no Purge gas flow. Temperature setpoints are maintained, unless the MCS and Cryofocusing Module are cooling to their setpoints (MCS Des Temp and CryoFocus Temp).

4.5.10 Cryofocusing Module Cooldown

The Cryofocusing Module cools desorbed analytes and focuses them on the head of the column before they are introduced into the GC. Every operating sequence does not use a Cryofocusing Module; this step is not required unless a Cryofocusing Module is installed. Setting the CryoFocuser parameter to "off" eliminates the cryofocusing steps from the operating sequence. The Cryofocusing Module will go to the Cryo Standby temperature. Dur-ing Cryofocusing Module Cooldown, the unit is cooled to its setpoint (CryoFocus Temp).

4.5.11 Desorb Preheat

During Desorb Preheat, the concentrator trap is heated to a specified temperature (Desorb Preheat) in preparation for analyte transfer from the trap to the GC. There is no flow through the concentrator trap during Desorb Preheat.

4.5.12 Desorb

During Desorb, the six-port valve rotates and the concentrator trap heats to a temperature setpoint (Desorb Temp) for the time specified in Desorb Time. Figure 4-8 and Table 4-7 show the valve configurations in the 3100 during Desorb.

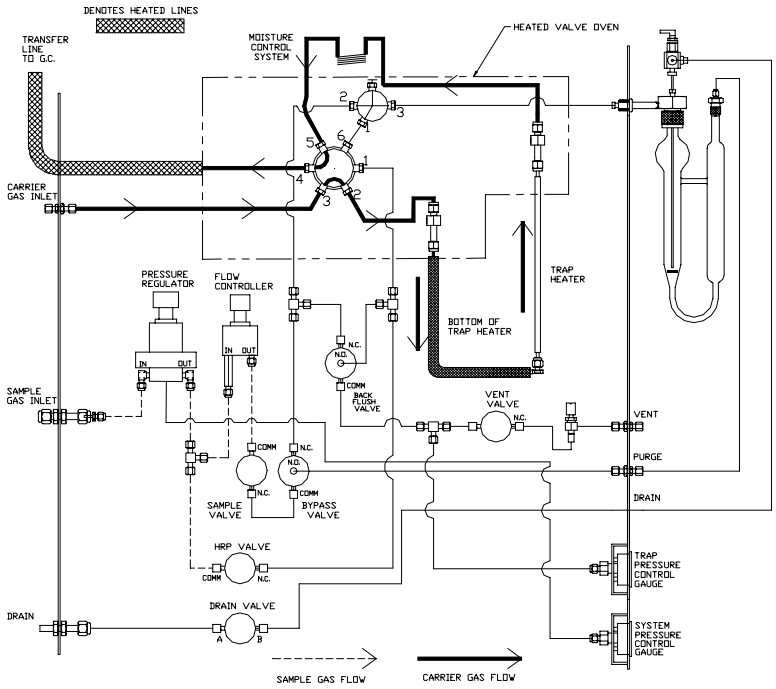


Figure 4-8 Valve Configuration during Desorb

Valve Designation:	Sample	Bypass	Vent	HRP	Drain	6-port	Backflush
Position:	closed	off	closed	closed	closed	Desorb	closed

Table 4-6 Valve Configuration during Desorb

Gas enters the 3100 at the carrier inlet, flows through the six-port valve, backflushes the concentrator trap through the MCS (where the water is trapped), and flows back to the six-port valve, where it exits through the transfer line to the GC. As the gas backflushes the trap, it carries released analytes over to the GC.

4.5.13 Desorb with Drain

If the 3100 is set to drain during Desorb, the HRP, sample, and drain valves are open, as shown in Table 4-7.

Valve Designation:	Sample	Bypass	Vent	HRP	Drain	6-port	Backflush
Position:	open	off	closed	open	open	Desorb	closed

Table 4-7 Valve Configuration during Desorb with Drain

4.5.14 Cryofocusing Inject

This is a timed step (specified by the Inject Time parameter) during which the Cryofocusing Module is heated to a programmed setpoint (Cryo Inj Temp). Heat releases the analytes that had been immobilized on the Cryofocusing Module column.

Note: Bake and Cryofocusing Inject begin at the same time.

4.5.15 Bake

Bake cleans out the sample pathway by heating the MCS and the concentrator trap to their programmed bake out setpoints (MCS Bake Temp and Trap Bake Temp) and blowing clean gas through the 3100 for the length of time specified in the Bake Time parameter.

During Bake with Bake Gas Bypass (BGB) off, gas follows the Purge flow path through the concentrator and glassware to sweep out all moisture and residual analytes. If the autodrain is on (i.e., drinking water samples), BGB should be off. This allows gas to dry out the glassware. If the autodrain is off (i.e., soils and wastewater samples), BGB should be on. With BGB on, there is no flow through the sample glassware. This prevents additional analytes being "purged" onto the trap during the Bake mode.

USING TEKLINK TO PROCESS SAMPLES

Chapter 5

5.1 Installing TekLink

This section offers information and instructions on system requirements, making a backup copy of the program disk, and installing TekLink onto your hard drive.

5.1.1 System Requirements

To install and use TekLink, you need an 80386 or higher computer with Microsoft Windows 3.1 or greater installed. Your system should have a hard drive that has at least two megabytes (MB) of free space and a floppy disk drive that reads 1.44MB (3 1/2") diskettes.

5.1.2 Making a Backup Copy of the Installation Disk

Before you install TekLink onto your hard drive, make a backup copy of the diskette(s) and use the backup for installation. Write-protect your backup copy to protect it from accidentally being copied over. Store the original in a secure place.

Note: Microsoft Windows version 3.1 (or greater) or Windows 95 must be installed on your computer before you can install TekLink.

5.1.3 To Install TekLink

1. Start Windows and insert your backup copy of TekLink into the appropriate floppy drive.
2. To begin the TekLink installation:

   Windows 3.x:

   - Choose File > Run in Program Manager.

   Windows 95:

   - Choose Start > Run...
3. Type A:\SETUP or B:\SETUP (depending on the drive you are using) in the Run dialog box and click OK.
4. Follow the screen prompts. The first screen that appears is the installation welcome screen (see figure 3.1.3.1).

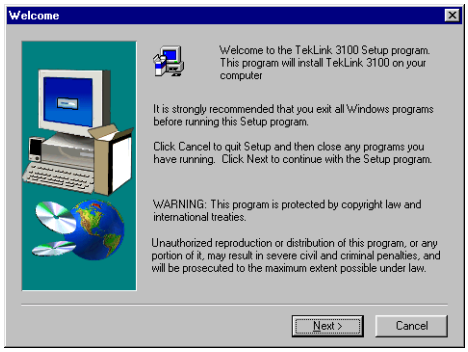


Figure 3.1.3.1 Installation Welcome Screen

5. Click Next.
6. The next installation screen appears:

Figure 3.1.3.2 Installation Choose Destination Location Screen

7. Select a destination location for TekLink. C:\TEK3100 is the default directory. You may Click Browse to select another file path.
8. Click Next.
9. You will then be prompted to select a Program Folder for TekLink. The default folder is TekLink 3100.

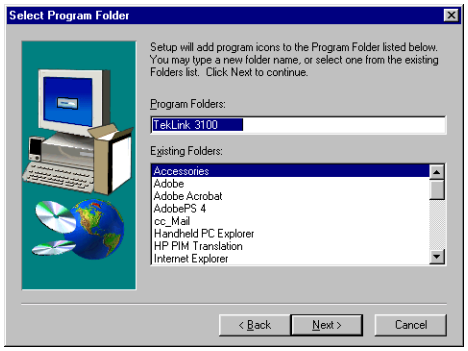


Figure 3.1.3.3 Installation Select Program Folder Screen

10. Click Next.

11. The final TekLink installation screen appears to confirm software installation:

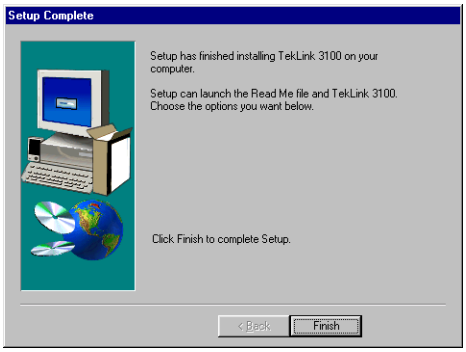


Figure 3.1.3.4 Installation Setup Complete Screen

12. Click Finish.

TekLink will be installed onto the drive and directory you specified. When the program is successfully installed, the TekLink icon (see figure 3.1.4) will appear in its own program group in the Windows Program Manager (Windows 3.x) or in Start > Programs > TekLink (Windows 95).

5.1.4 To Start TekLink

Windows 3.x:

- In Program Manager, double-click on the TekLink 3100 program folder and then double-click on the TekLink 3100 icon (see figure 3.1.4).

Windows 95:

- Choose Start > Programs > TekLink 3100. Select the TekLink 3100 program file.

Figure 3.1.4 TekLink 3100 Program Icon

5.2 Configuring the Concentrator with TekLink

The 3100 sample concentrator processes liquid or soil samples for analysis by gas chromatography and operate automatically, under microprocessor control, to process a single front-panel sample or multiple samples loaded from an autosampler. When programmed with custom methods, this system can operate at different time and temperature parameters and run different analytical sequences on specified samples.

You can program custom operating sequences for up to four concentrators by using a personal computer running TekLink. TekLink makes it possible for you to use a personal computer running Microsoft Windows to monitor, schedule, and control the operation of one, two, three, or four concentrators.

Before you begin setting up methods and running samples, please familiarize yourself with the TekLink software as described in this section. TekLink must recognize and be configured correctly with the concentrator/autosampler in order to run properly.

5.2.1 Flash Upgrading the 3100 ROM

Tekmar-Dohrmann is committed to continuous product enhancement. The 3100 memory board ROM is flash upgradable and can be upgraded easily by running the Flash Upgrade program that is included with TekLink.

If you ever need to flash upgrade the 3100 memory board ROM, please follow the instructions in section 3.2.1.1

5.2.1.1 Performing the Flash Upgrade

1. Open the Flash program:

   Windows 3.x:

   - In Program Manager, double-click on the TekLink 3100 program folder and then double-click on the Flash program icon (see figure 3.2.1.1a).

   Windows 95:

   - Choose Start > Programs > TekLink 3100. Select the Flash program file.

Figure 3.2.1.1a TekLink 3100 Flash Program Icon

2. Click on File and select Configure Ports.

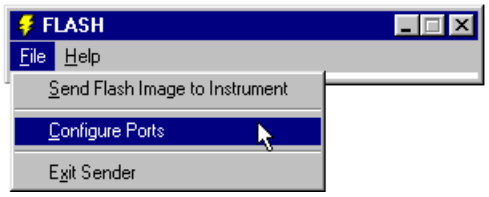


Figure 3.2.1.1b TekLink 3100 Flash Configure Ports

3. Enter the Com Port number the 3100 unit is connected to.

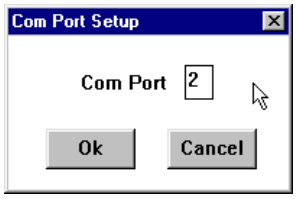


Figure 3.2.1.1c TekLink 3100 Flash Com Port Setup

4. Click OK.

5. Select File > Send Flash Image to Instrument.

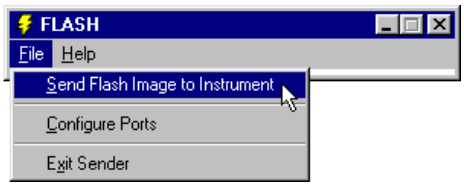


Figure 3.2.1.1d Send Flash Image to Instrument

6. Select the ROM Image File furnished to you by Tekmar-Dohrmann. The file will have the version name followed by the .bin extension.

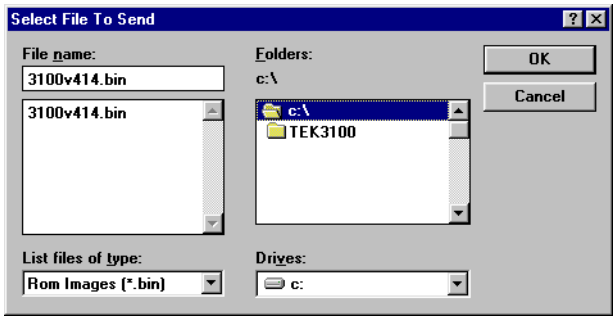


Figure 3.2.1.1e Select File to Send

7. Click OK.

Figure 3.2.1.1f Flash Burning Process Window

8. You will see the Flash Burning Process in this window. There are four indicators depicting the burning progress:

   a) Stage reflects the current state for each sector

   b) Current Sector is a progress indicator

   c) Error Count indicates the number of errors encountered while trying to communicate with the 3100. After 3 errors, the Flash program will abort.

   d) Verify Errors indicates the number of errors encountered while trying to verify a sector on the 3100. After 3 errors, the Flash program will abort.

9. If the Flash programs aborts, one of three messages will appear:

   a) Connect Error

   b) Lost Communication with Instrument

   c) Can't Program Current Sector

   Check the TekLink port configuration to verify the correct com port setup. If you continue to encounter errors, please call Tekmar-Dohrmann's Technical Support Department. Inside the US and Canada: (800) 874-2004; outside the US and Canada: (513) 247-7000.

10. When Flash programming is successful, a status window will appear

11. If Flash programming is complete, with no errors, exit out of the Flash program, power down the 3100, then power up the 3100. Your 3100 should now be updated with the new ROM version.

12. To verify the programming of your ROM upgrade, launch TekLink 3100 and click on the Help menu. Select About TekLink. Your new ROM version, listed after "3100 Firmware Version", should correspond with the new ROM version programmed.

5.2.2 TekLink Control Screen

When you first run TekLink, the TekLink Control Screen appears. The Control Screen serves as the primary interface between the computer and the concentrator's configuration, instrument, setup, status, and operation capabilities.

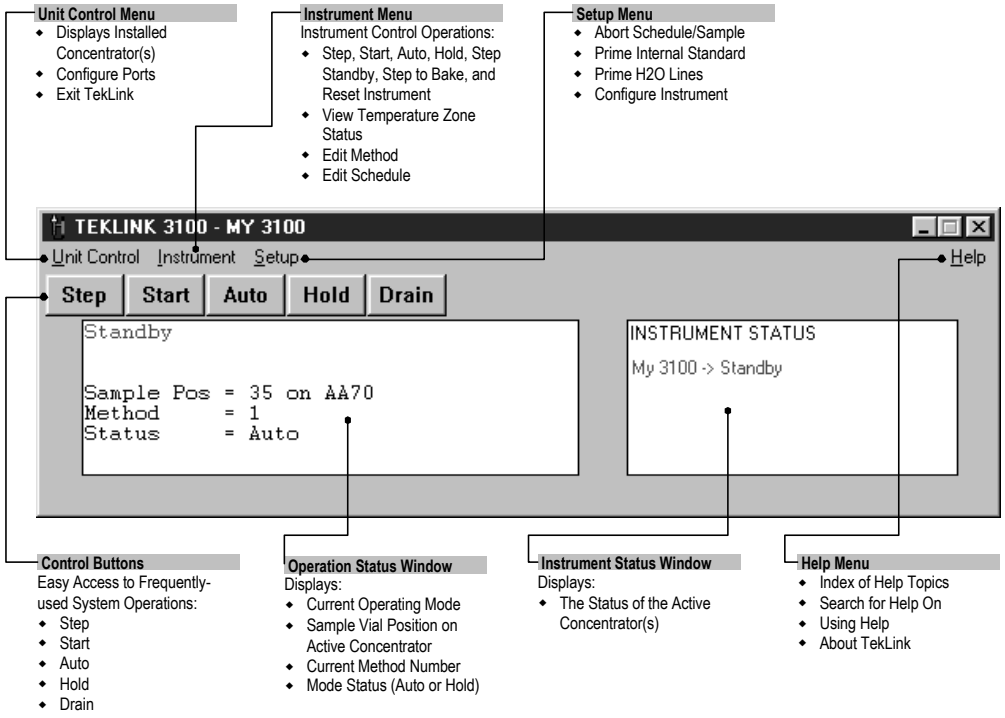


Figure 3.2.2 TekLink Control Screen

Note: The Drain control button is only active when an AQUATek 70 method is running.

5.2.3 Configuring COM Ports

TekLink must be configured to identify each connected concentrator with its appropriate COM (communication) port and must also designate a single concentrator as active (see section 3.2.4) before further analysis settings can be made.

5.2.3.1 To Link Each Concentrator With a COM Port

1. From the Control Screen, choose Unit Control > Configure Ports.

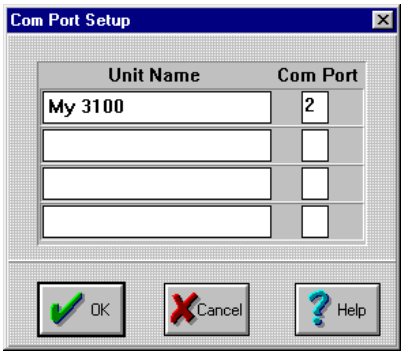


Figure 3.2.3.1 COM Port Setup Screen

2. Type the name of the concentrator you are installing in the Unit Name field (this can be any name).
3. Type the number (1-4) of the COM port that the concentrator is connected to in the Com Port field.
4. Repeat steps 2-3 for each additional concentrator that is connected to your PC.
5. Click OK to return to the Control Screen.

Note: If one of the COM ports is not responding or is unavailable, TekLink displays an RS232 Error Message Screen (see section 3.2.3.2).

5.2.3.2 To Correct the RS232 Error Message During COM Port Setup

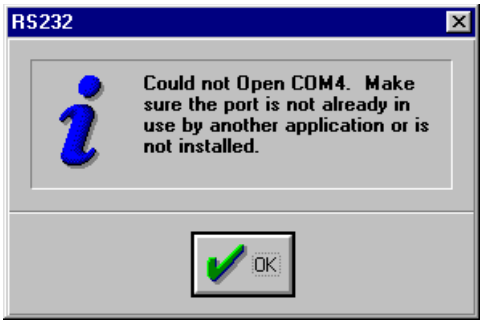


Figure 3.2.3.2 RS232 Error Screen

1. Click OK to close the RS232 Error screen.
2. Make sure all COM port and instrument connections are secure.
3. Check the COM port number of your computer.
4. Repeat steps 1-5 in section 3.2.3.1. If the error message appears again, please call Tekmar-Dohrmann Technical Support at (800) 874-2004 for further assistance.

Note: A possible error may occur if the flash.exe program (or any other program that may be using the same com port) is running while configuring the com ports in TekLink. If this occurs, close the conflicting program and continue with setup.

5.2.4 Designating an Active Concentrator

After you have assigned a name and have configured each connected concentrator to a COM port on your PC, you must specify one of them as the active unit.

Note: You must specify an active unit in order to send, receive, and/or schedule methods. However, you can edit methods without tying them to a selected active unit.

5.2.4.1 To Designate an Active Concentrator

1. From the Control Screen, select the Unit Control menu.

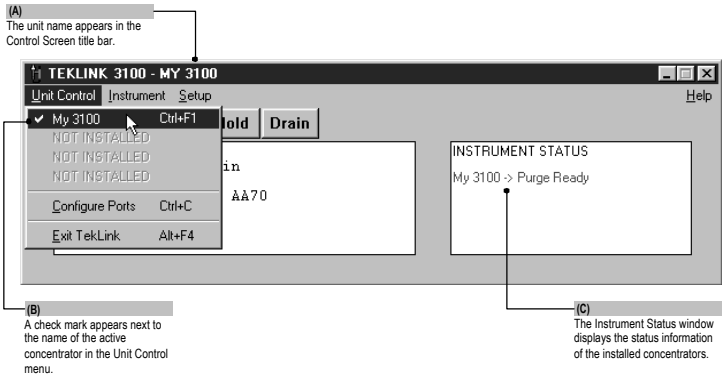


Figure 3.2.4.1 Unit Control Menu Displaying the Active Concentrator

The top portion of the Unit Control menu lists each concentrator that is connected to the PC and configured in TekLink.

2. Click on the name of the concentrator you want to run.
3. After you select the active unit, click outside of the TekLink screen to close the Unit Control menu.
4. To verify the name and status of the designated active unit, observe the Instrument Status window of the Control Screen (see figure 3.2.4.1).

   (A) The name of the selected unit appears in the Control Screen title bar.

   (B) A check mark appears next to the selected name in the Unit Control menu.

   (C) The Instrument Status window displays status information for the active concentrator.

5.2.5 Specifying Concentrator Configurations

TekLink allows you to specify the instrument configuration of any active concentrator.

To access the Instrument Configurations screen:

1. From the Screen, select Setup > Configure Instrument.

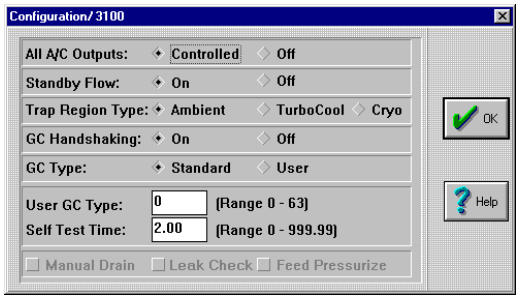


Figure 3.2.5 Configure Instrument Screen

2. Configure the concentrator by selecting options specific to your system configuration.
3. Click OK to return to the Control Screen.

5.2.5.1 All A/C Outputs

Use this option to specify whether the A/C Outputs are controlled or off.

5.2.5.2 Standby Flow

The Standby Flow option indicates whether or not the sample pathway is swept with gas during the Standby step.

5.2.5.3 Trap Region Type

The Trap Region option has three valid values:

1) Ambient: the concentrator uses the standard internal trap at ambient temperature.
2) TurboCool: the concentrator operates at cryogenic temperatures when the TurboCool unit (optional) is installed.
3) Cryo: the concentrator operates at cryogenic temperatures when the Cryofocusing Module (optional) is installed.

5.2.5.4 GC Handshaking

The GC Handshaking option specifies GC handshaking characteristics.

A) On normally operates the GC's port.

B) Off operates the GC with no input or output signals between the concentrator and the GC.

5.2.5.5 GC Type

You can configure the concentrator for either a Standard or User type GC Port. The GC type classification is based on the input-output characteristics of the GC as it interacts with the concentrator.

5.2.5.6 User GC Type

If you have ordered an interface cable, the User GC Type is provided with the cable. If you have not ordered a cable, you must know the characteristics of the input and output signals traveling to and from the GC to determine the GC User Type.

5.2.5.7 Self-Test Time

The Self-Test Time option allows you to specify a Self-Test Time other than the default.

5.2.5.8 Manual Drain Mode

The drain valve allows the sample glassware to be emptied. When it is open, liquid and gas can be forced out of the sample glassware into the drain system and out the back panel drain.

5.2.5.9 Leak Check Mode

The Leak Check Mode option is only accessible during Purge mode.

5.2.5.10 Feed Pressurize Mode

The vent allows sample gas to exit the sample pathway through a front panel vent. When it is closed, pressure builds up in the sample pathway. This is used to set the feed pressure (it eliminates Trap Pressure Control [TPC] effects).

5.3 Using Methods

After you have installed and configured the concentrator, you can create customized methods (operating sequences) for sample processing that meet your analytical requirements.

After you have connected the required concentrator(s) and configured your PC's COM ports to recognize the connected units, you can use the Method Editor to review and edit methods.

5.3.1 Understanding the Method Editor Screen

To access the Method Editor screen:

1. From the Control Screen, select Instrument > Edit Method.

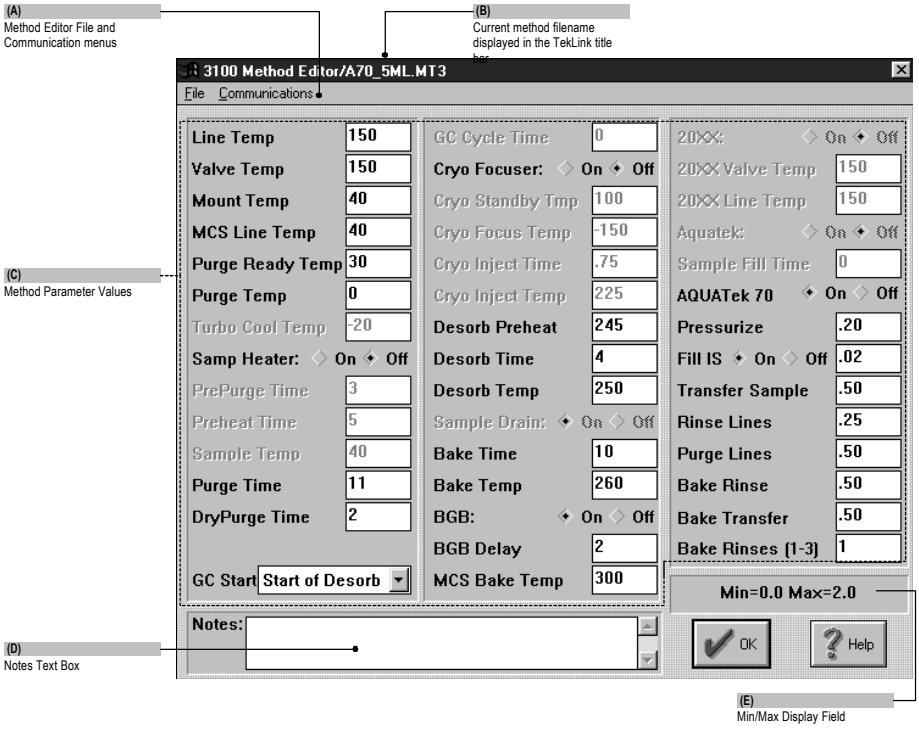


Figure 3.3.1 Method Editor Screen

5.3.1.1 Default 3100 Method Parameter Values

At first power up, the concentrator is scheduled to run 3100.mt3 which is the 3100 default front panel method. The concentrator automatically performs self tests and remains in Standby until all heaters and coolers have reached their default temperature setpoints. When temperature setpoints have been reached, the concentrator goes into Purge Ready mode. At this point, you can either press the Start control button to begin running 3100.mt3 with its default parameters or create, change, or select another method schedule.

The default 3100 method file, 3100.mt3, is the default method specifically configured for the 3100 and 3100.

Note: The 3100 method parameter defaults are guidelines. You may need to edit certain values depending on your analysis requirements.

Method Parameter	Value
Line Temp	150ºC
Valve Temp	150ºC
Mount Temp	40ºC
MCS Line Temp	40ºC
Purge Ready Temp	30ºC
Purge Temp	0ºC
Turbo Cool Temp	-20ºC
Sample Heater	Off
PrePurge Time	3 Minutes
Sample Preheat Time	5 Minutes
Sample Preheat Temp	40ºC
Purge Time	11 Minutes
DryPurge Time	0 Minutes
GC Start Option	Start of Desorb
GC Cycle Time	0 Minutes
Cryo Focuser	Off
Desorb Preheat Temp	245ºC
Desorb Time	4 Minutes
Desorb Temp	250ºC
Sample Drain	Off
Bake Time	10 Minutes
Bake Temp	280ºC
Bake Gas Bypass	On
Bake Gas Bypass Delay Time	2 Minutes
MCS Bake Temp	310ºC

Table 3.3.1.1 Default Method Parameter Values for 3100.mt3
(3100 Front Panel Sampling)

5.3.2. Method Editor File Menu

The File menu (see figure 3.3.2) of the Method Editor screen contains options for loading, saving, printing, and deleting method files.

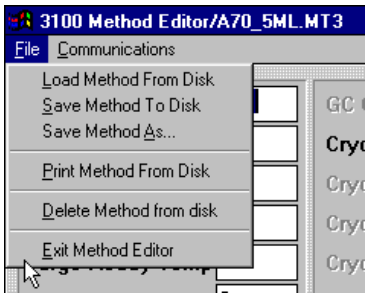


Figure 3.3.2 Method Editor File Menu

5.3.2.1 Load Method From Disk

TekLink contains one default method file for the 3100. Select one to view and edit. All method filenames end with .mt3. Please review table 3.3.1.1 for default parameter values.

To load a method from the disk:

1. From the Method Editor screen, select File > Load Method From Disk.

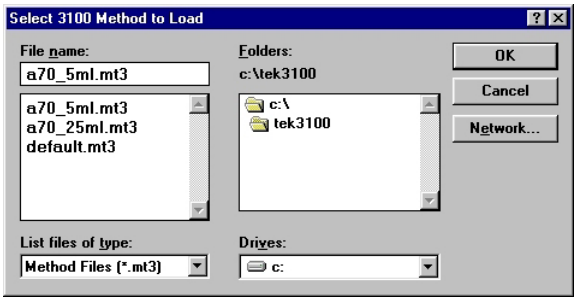


Figure 3.3.2.1 Select Method to Load Screen

Note: You cannot load method files from previous versions of TekLink.

2. Select the method file you want to load.
3. Click OK to return to the Method Editor screen. All parameters will reflect the values of the loaded method.

5.3.2.2 Save Method to Disk

Select File > Save Method to Disk to save the current method file.

5.3.2.3 Save Method As...

Select File > Save Method As... to save the current method configuration under a new filename.

5.3.2.4 Print Method From Disk

Select File > Print Method From Disk to print out the parameter listing of a method file.

5.3.2.5 Delete Method From Disk

Select File > Delete Method From Disk to permanently remove a saved method file from your hard drive.

5.3.2.6 Exit Method Editor

Select File > Exit Method Editor to exit out of the Method Editor screen and return to the Control screen.

5.3.3 Method Parameter Values

Three columns (see 'C' in figure 3.3.1) display values that define time, temperature, and other operational parameters for the current method. If a parameter and its value are grayed out (or uneditable), then the accessory required is not installed on your system. Please refer to the concentrator user manual for further descriptions and explanations of specific method parameters.

Note: If you have system accessories (e.g., Cryo Focuser, 20XX, AQUATek 50, or AQUATek 70) connected to your concentrator, be sure to turn them On in the Method Editor.

5.3.4 Notes Text Box

The Notes text box (see 'D' in figure 3.3.1) permits you to store up to 200 characters of text. TekLink stores the Notes with the Method File when saved.

5.3.5 Min/Max Field

The Min/Max field (see 'E' in figure 3.3.1) displays the minimum and maximum setting for each parameter value when the cursor is placed within a parameter field.

5.3.5.1 Method Parameter Value Out of Range Error

Note: If the value you enter in the Method Editor is greater than the maximum or smaller than the minimum values shown in the Min/Max readout, TekLink displays an error message.

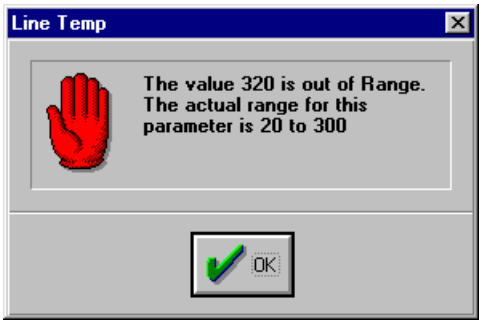


Figure 3.3.5.1 Method Parameter Value Out of Range Error Screen

To clear the error message:

1. Click OK. The parameter value defaults to its previous entry.
2. Enter a parameter value that is within the acceptable min/max range.

5.4 Defining a Method Schedule

After you create customized methods, you can define a method schedule that specifies samples, operating sequences, and the order in which they will run.

5.4.1 Understanding the Schedule Control Screen

To access the Schedule Control screen, select Instrument > Edit Schedule from the Control Screen.

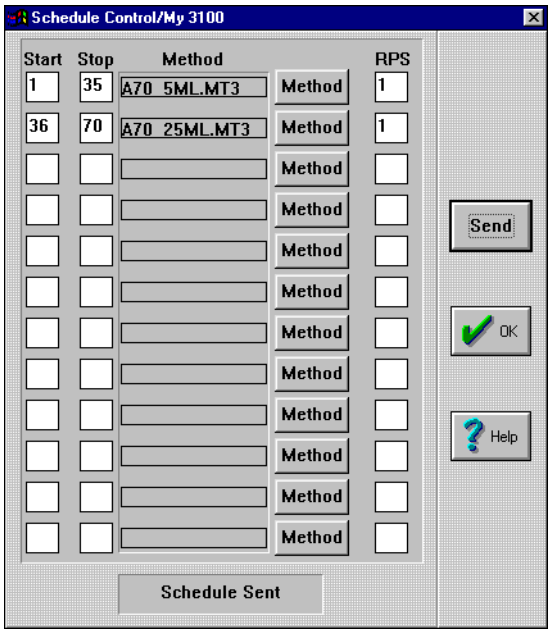


Figure 3.4.1 Schedule Control Screen

The Schedule Control screen has four columns and 12 rows for creating up to 12 method schedules.

5.4.1.1 Start and Stop Fields

Enter the vial position number of the first sample in the Start field and the vial position number of the last sample in the Stop field to be run according to the specified method. (The default sample start and stop positions are both 0, the number assigned to the 3100 front-panel sample on the concentrator unit.)

5.4.1.2 Method Display Field and Method Selection Button

Click the Method selection button to select the filename of the method you want to schedule. The filename of the method you select appears in the method display field.

5.4.1.3 RPS (Runs Per Sample) Field

Enter the number of times each sample will be run.

5.4.1.4 Min/Max Field

The Min/Max parameter status field at the bottom of the Schedule Control screen displays the minimum and maximum autosampler vial positions for the selected method.

5.4.1.5 Load Schedule Button

Press the Load button in the Schedule Control window to open up a saved schedule file. The file extension for all saved schedules is ".sch".

5.4.1.6 Save Schedule Button

Press the Save button in the Schedule Control window to save the current schedule setup information to disk. The file extension for all saved schedules is ".sch".

5.4.1.7 Print Schedule Button

Press the Print button in the Schedule Control window to send the current schedule information to the default printer.

5.4.1.8 Delete Schedule Line Button

Press the Del Line button in the Schedule Control window to delete the line in the current schedule. Make sure that you place the cursor somewhere in the line to be deleted.

5.4.1.9 Send Schedule Button

The Send button sends the currently displayed schedule to the active concentrator.

5.4.1.10 OK Schedule Button

The OK button exits the Schedule Control screen and returns to the Control Screen.

Note: You will not be prompted to save the current schedule if it has changed or if you have not already saved it.

5.4.1.11 Schedule Control Help Button

The Help button accesses online help information about the Schedule Control screen.

5.4.2 Scheduling Runs

You can use the Schedule Control screen to set up a method schedule, or processing timetable, for running samples. When you use the concentrator without an autosampler, you specify the number and sequence of methods to be run on a single sample.

When you use the concentrator with one or more autosamplers, you set up a method schedule that defines:

- The method(s) to be run.
- Start and stop positions for each method.
- A sequential order for each sample to be run.
- The number of runs per sample.

You must use the Schedule Control screen to set up a schedule, even if you are running a front-panel sample position with the concentrator.

You can enter any desired method schedule and send it to the selected concentrator within the Schedule Control screen. Use the worksheet included in your concentrator user manual to develop a method schedule.

5.4.2.1 Entering a Method Schedule

1. Click the Method button.
2. Select the method file of the method you want to run.
3. Click OK to return to the Schedule Control screen.

Note: If the method file you loaded is incorrect, click the Method button again in the Schedule Control screen and select the correct file.

4. Position the cursor on the Start field.
5. Type the position number of the first sample vial to be run according to its method.
6. Position the cursor on the Stop field.
7. Type the position number of the last sample vial to be run according to its method.

Note: If you enter an out-of-range sample vial position value, an error message (see figure 3.4.2.1) will appear. It is important that you first select the method and then enter the start and stop positions. If you enter a position number that is out-of-range, the error will occur when TekLink begins to run the scheduled method with the out-of-range position.

Figure 3.4.2.1 Autosampler Position Value Out-of-Range Error Dialog

8. Type the number of times you want the sample to run in the RPS (runs per sample) field.
9. Click the Send button to transmit the current method schedule and required files to the active concentrator.

Note: Selecting the OK button will not send your schedule to the concentrator and will not save the schedule you have edited. You must select the Send button in the Schedule Control to run the schedule. The schedule has been successfully sent to the concentrator when the bottom of the Schedule Control screen reads “Schedule Sent”.

10. Click Print to print the current schedule, Save to save the current schedule to disk, or OK to return to the Control Screen.

After sending a method schedule to the active concentrator, the Operation Status window of the Control Screen displays the current status information for the active concentrator: current mode, sample position, and method filename.

The active concentrator will remain in Standby until the concentrator temperature setpoints (see section 3.4.2.2) are reached. When setpoints are reached, the active 3100 will step to Purge Ready. You may begin running samples at this time.

5.4.2.2 Temperature Zone Status

The concentrator and its optional accessories must reach prescribed temperature setpoints prior to running samples.

To review the Temperature Zone Status for all installed components:

1. From the Control Screen, select Instrument > Temp Zone Status.

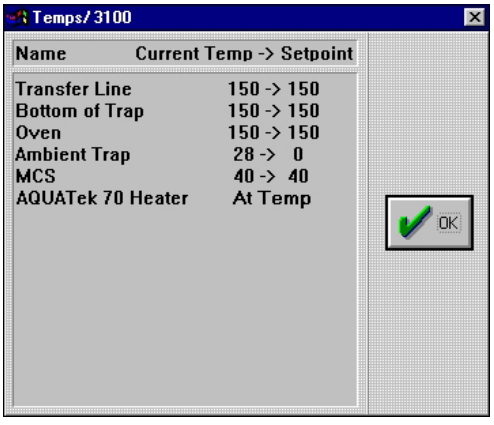


Figure 3.4.2.2 Temp Zone Status Screen

Note: You may review the status of the temperature zones at any time.

5.5 Running Samples

5.5.1 Overview of the Control Buttons

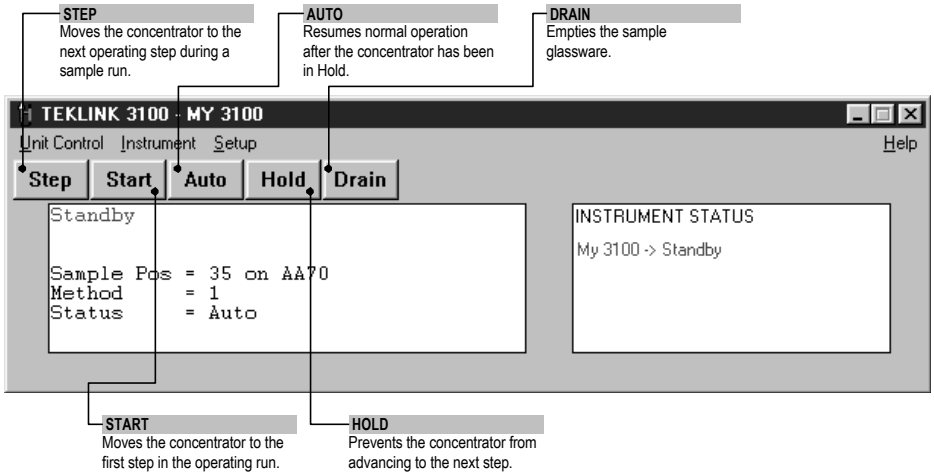


Figure 3.5.1 TekLink Control Buttons

5.5.2 To Initiate a Run

1. Click the Start control button or select Instrument > Start to begin a sample run.

The concentrator will proceed to the first operating step in the scheduled method.

5.5.3 Changing the Normal Operating Sequence During a Sample Run

At times, you may find it necessary to interrupt, change, and/or abort the normal operating sequence of a sample schedule in progress.

5.5.3.1 Step

1. Click the Step button to advance through the operation steps (or modes) of an operating sequence.

Note: You can step the instrument even if certain temperature setpoints for the active concentrator have not yet been achieved.

Step ends the current operating step and moves the concentrator to the next operating step of the current method.

5.5.3.2 Hold

1. Click the Hold button to stop the concentrator from advancing to the next operating step.

While the system is in Hold:

- The Operation Status window of the Control Screen shows that the status of the active concentrator is in Hold.
- The dynamic timer continues to progress, allowing you to monitor the duration of a specific operating step.
- If the timer times out, the concentrator will remain in the current operating step until the Auto button is selected.

5.5.3.3 Auto

1. Click the Auto button to take the active concentrator out of Hold and to resume the normal step progression.

5.5.3.4 To Step to Standby

1. From the Control Screen, select Instrument > Step Standby.

Note: A warning screen will ask you whether or not you want to step the concentrator to Standby. If you select Yes, the current sample and schedule will be aborted.

5.5.3.5 To Step to Bake

1. From the Control Screen, select Instrument > Step to Bake.

Note: A warning screen will ask you whether or not you want to step the concentrator to Bake. If you select Yes, the current sample and schedule will be aborted.

5.5.3.6 To Reset the Concentrator

1. From the Control Screen, select Instrument > Reset Instrument.

Note: A warning screen will ask you whether or not you want to reset the instrument. If you select Yes, the concentrator will:

- abort the current run and schedule
- perform its self tests
- hold in Standby

5.5.4 Aborting a Schedule and/or Sample

To abort a schedule and/or sample run that is in progress:

1. From the Control Screen, select Setup > Abort Schedule/Sample.

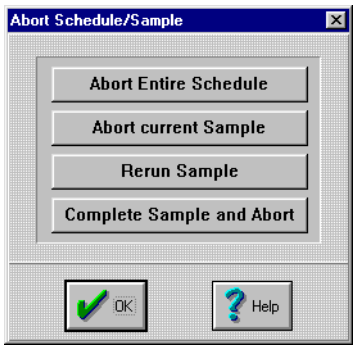


Figure 3.5.4 Abort Schedule/Sample Screen

5.5.4.1 Abort Entire Schedule

Select Abort Entire Schedule to abort the entire schedule/ sample in progress. The active concentrator will return to Standby for the first scheduled method.

Note: Selecting Abort Entire Schedule will step the concentrator to Bake for 9.5 minutes and will drain the contents of the concentrator glassware.

5.5.4.2 Abort Current Sample

Select Abort Current Sample to abort the sample in progress. The active concentrator will then proceed to the next scheduled sample.

Note: Selecting Abort Current Sample will step the concentrator to Bake for 9.5 minutes and will drain the contents of the concentrator glassware.

5.5.4.3 Rerun Sample

Select Rerun Sample to abort and rerun the current sample.

5.5.4.4 Complete Sample and Abort

Select Complete Sample and Abort to finish running the current sample and to abort the rest of the schedule. The active concentrator will finish the sample that is running and return to beginning of the schedule, go to Standby.

5.6 TekLink Error Messages

The following are TekLink dialog messages regarding errors that may occur. Please refer to your concentrator user documentation for descriptions of error messages specific to 3100 operation.

5.6.1 Maximum Failsafe Exceeded on Heater X*

Displayed heater has exceeded its maximum allowable temperature.

5.6.2 Minimum Failsafe Exceeded on Heater X

Displayed heater has dropped below its minimum allowable temperature.

5.6.3 Open Thermocouple on Heater X

Displayed heater is disconnected or has opened up.

5.6.4 Out-of-Range Error While Scheduling

The value (sample vial position number) entered in either the Start or Stop fields in the Schedule Control screen are incorrect for the chosen method. When you click OK, the values return to their defaults.

5.6.5 Power Fail

Power to the concentrator was dropped while it was on.

5.6.6 Sample Method Does Not Match Schedule Position

The current schedule and the method it is set to use do not match. Example: An AQUATek 70 method being run on position 0 (which is the front panel and not the autosampler); or a 3100 method being run on position 12 which is not a front-panel method.

5.6.7 Self-Test Failure on Heater X

The displayed heater did not pass self test.

5.6.8 System Reset

The concentrator was reset by either the reset button on the concentrator or in TekLink. The concentrator will go through self test after a reset.

5.6.9 Setpoint Not Reached on Heater X

The displayed heater could not reach its setpoint.

** X denotes a particular heater name.*

5.6.10 AQUATek ASM Not Responding

Make sure the AQUATek 70 and autosampler are turned on and that they are recognized by and configured in TekLink. An AQUATek 70 method may be loaded in TekLink while there is no AQUATek 70.

5.6.11 AQUATek Sensor Error

This error will occur when the base temperature of the hot water tank inside the AQUATek 70 does not reach temp. The sensor board screw on top of the hot water tank may be loose or the sensor board may need replacement.

Note: Please refer to the AQUATek 70 user manual for further instruction.

5.6.12 AQUATek Heater Error

This error will occur when the secondary temperature of the hot water tank inside the AQUATek 70 continues to try and reach temp for over 20 minutes. The sensor board screw on top of the hot water tank may be loose, the sensor board may need replacement, or the hot water tank assembly may need replacement.

Note: Please refer to the AQUATek 70 user manual for further instruction.

USING THE HAND-HELD CONTROLLER TO PROCESS SAMPLES

Chapter 6

6.1 Overview

With the 3100's hand-held controller, you can program and run analytical methods. This section tells you how to:

- Use the 3100's hand-held controller.
- Read status screens on the hand-held controller and the front panel screens.
- Power up the 3100 and run self tests.
- Configure the 3100 to operate with your gas chromatograph (GC).

6.2 Using the Hand-Held Controller

The hand-held controller consists of a four-line, 20-character wide, LCD (liquid crystal display) and a 30-key keypad (Figure 6-1).

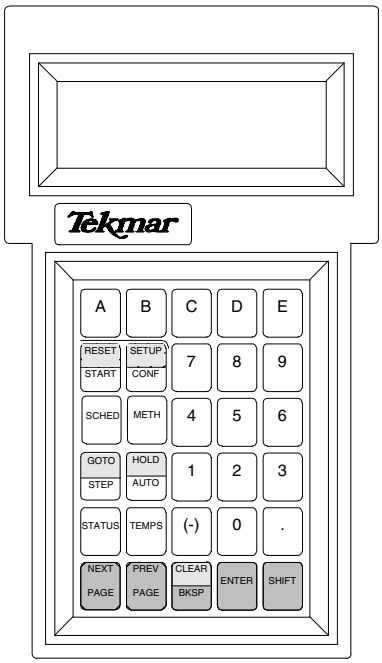


Figure 6-1 Tekmar 3100 Hand-held Controller

You use the keypad and display screen to communicate with the 3100.

- The four-line controller screen displays data entry fields for programming, menus for selecting commands, and status information for viewing during operation.
- The controller keypad consists of five variable-function keys, 13 control keys, and 12 numeric keys. You can use the keys to monitor the 3100's operational status and program it to run different operating sequences.

6.2.1 Installing the Hand-held Controller

The hand-held controller comes with an interface cable.

1. Locate the jack on the bottom of the front panel display housing.
2. Plug the end of the cable into the front panel jack.
3. Plug the other end of the cable into the jack on the bottom of the controller.

6.2.2 Variable Function Keys

Keys in the first row (labeled A - E) are used to select options from a screen menu. Their function varies, depending on the options displayed on the current screen. For example:

- From the Setup screen, press the A key to display system information.
- From the Reset screen, press the A key to abort a schedule.

6.2.3 Control Keys

The control keys consist of:

- Action keys (RESET, START, AUTO, HOLD, STEP, and GO TO). These keys start, control, and stop analytical runs.
- Screen keys (SETUP, CONF, STATUS, SCHED, METH, and TEMPS). These keys display screens that enable you to define operating parameters, set up schedules, and review status and temperature.
- Special keys (NEXT/PREV PAGE, BKSP, CLEAR, and SHIFT). These keys let you scroll through displays or manipulate and save data.

Keys with two-part labels have two functions. To use the function on the lower half of the label, press the control key. To use the function on the upper half of the label, press and hold SHIFT while you press the control key.

6.2.3.1 Action Keys

This key:	Performs this function:
RESET	RESET lets you abort a acheduled run, abort the processing of a single sample, rerun a sample, or reset the microprocessor to start-up status. Press and hold SHIFT while you press RESET.
START	START moves the 3100 to the first step in an operating run (usually Purge).
GO TO	GO TO lets you stop an operating run and immediately go to Standby, Desorb Preheat or Bake. Press and hold SHIFT while you press GO TO.
STEP	STEP moves the 3100 to the next operating step in a program.
HOLD	HOLD prevents the 3100 from advancing to the next step. Press and hold SHIFT while you press HOLD.
AUTO	AUTO resumes normal operation after the 3100 has been in HOLD.

Table 6-1 Action Key Functions

6.2.3.2 Screen Keys

This key:	Performs this function:
SETUP	SETUP allows you to access basic system information, set the time and date, and adjust contrast for the status screen. Press and hold SHIFT while you press SETUP.
CONF	CONF displays the Configuration screens that allow you to configure the 3100 to run with your GC (gas chromatograph).
SCHED	SCHED displays the Scheduling screen that allows you to edit and enable method schedules (processing timetables that define sample positions and the order in which selected methods will be run) and review the current status of scheduled runs.
METH	METH displays the Select Method screen that allows you to select a method and change its parameters.
STATUS	STATUS displays a Status screen that shows the current operating step and its controlling parameters.
TEMPS	TEMPS displays the Temperatures screens, which show temperature setpoints and actual readings for all actively controlled temperature zones.

Table 6-2 Screen Key Functions

6.2.3.3 Special Keys

This key:	Performs this function:
NEXT PAGE	For screens that contain more than one screen of data, NEXT PAGE scrolls down to display the next screen of data.
PREV PAGE	For screens that contain more than one screen of data, PREV PAGE scrolls up to display the previous screen of data.
CLEAR	CLEAR erases an entry completely. Press and hold SHIFT while you press CLEAR.
BKSP	BKSP deletes the character beneath the cursor.
ENTER	ENTER saves your entry and moves the cursor to the next data entry field.
SHIFT	SHIFT activates the light gray labeled functions on two-part control keys. Press SHIFT, hold it down, and press the selected key to execute the shifted function.

Table 6-3 Special Key Functions

6.2.4 Numeric Keys

You use the numeric keys 0 through 9, . (decimal point) and **-** (negative sign) for entering numeric data such as time or temperature parameters.

To enter numeric data:

1. Press the desired numeric keys, including the decimal place and the negative sign, if required.
2. Press the ENTER key.

To clear the last character, press BKSP.

To clear an entry completely, press and hold SHIFT while you press CLEAR.

6.3 Using Screens

The 3100 hand-held controller uses several types of display:

- A two-line, front panel status display.
- Status screens (on the hand-held controller).
- Menu screens (on the hand-held controller).
- Action screens (on the hand-held controller).
- Data entry screens (on the hand-held controller).

6.3.1 Front Panel Status Display

During each operating step of a run, the front panel screen continuously displays two lines of status information.

6.3.1.1 Temperature Parameter Display

When the temperature setpoint is the controlling parameter for the step, the front panel screen displays the information illustrated in Figure 6-2.

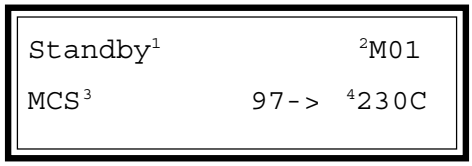


Figure 6-2 Front Panel Status Screen

Each part of the screen above is labeled with a number. See the matching numbers below to find out more about each part of the screen.

1. The name of the operating step appears on the first line, at the left margin.
2. The number of the currently-active method appears on the first line, at the right margin. If the 3100 is running a method schedule, this position shows the currently-active method number and currently-active sample position. For example, M7P04 indicates that method 7 is running on sample position 4.
3. The name of the heated or cooled zone and its current measured temperature appear at the left on the second line. The display updates this value continuously as the temperature changes.
4. The temperature setpoint for the step appears at the right on the second line.

6.3.1.2 Time Parameter Display

When a time setpoint is the controlling parameter for the step, the front panel screen displays the information illustrated in Figure 6-3.

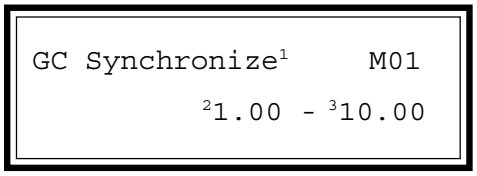


Figure 6-3 Front Panel Timer Screen

1 The name of the operating step appears on the first line, at the left margin.

2 The elapsed time appears on the second line. The display updates this value continuously.

3 The total time setpoint appears at the right on the second line.

6.3.2 Status Screens

A status screen may display:

- A listing of temperatures for all the actively-controlled heated or cooled zones in the 3100.
- Information about the current status of a run. Each operating step has a corresponding Operating Status screen. You can check the progress of the run by reviewing the current Operating Status screen. This section describes the Operating Status Screens.

6.3.2.1 Displaying Operating Status Screens

To display an operating status screen at any point during operation, press the STATUS key. The 3100 displays an Operating Status screen like the one in Figure 6-4.

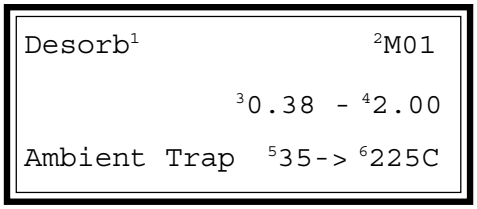


Figure 6-4 Desorb Screen

6.3.2.2 Reading the Fields

Operating Status screens display the following information:

1. The name of the operating step appears on the first line, at the left margin.
2. The number of the currently-active method appears on the first line, at the right margin. If the 3100 is running a method schedule, this position shows the currently-active method number and currently-active sample position. For example, M7P04 indicates that method 7 is running on sample position 4.
3. For timed steps, the elapsed time appears on the third line. The display updates this value continuously.
4. For timed steps, the total time setpoint appears at the right on the third line.
5. For temperature-dependent steps, the name of the heated or cooled component and its current measured temperature appears at the left on the fourth line. The display updates the temperature value continuously.
6. For temperature-dependent steps, the temperature setpoint appears at the right on the fourth line.

6.3.3 Menu Screens

Menu screens offer lists of variable-function key options. You press the indicated key to make a selection. Table 6-4 on the following page shows some of the menu screens and the keys which access them.

Press this key:	to display these menu screen choices:
SETUP	A = System Info B = Time/Date
SCHED	A = Sample Status C = Commands E = Edit Schedule
METH	Select Method C = Commands E = Edit
C (from the Select Method screen)	Commands: Method A = Change Type C = Restore Default E = Copy Method

Table 6-4 Menu Screens

6.3.4 Action Screens

An action screen presents a choice of variable function keys. It looks like a menu screen, but there is a difference: pressing a variable function key from a menu screen displays another screen. Pressing a key from one of the action screens shown in Table 6-5 on the following page initiates an action.

Press this key:	to display these choices:
RESET	A = Abort Schedule B = Abort Sample C = Rerun Sample D = Complete and Abort
STEP (from a Self-test Screen)	A = Continue Testing B = Ignore Self-test C = Restore Previous
C (from the Scheduling Screen	A = Run Schedule B = Update* Schedule C = Clear Schedule
GO TO	A = GoTo Mode B = Manual Operation
Various keys from various screens	A = Abort (cancel action) E = Execute (perform selected action)

Table 6-5 Action Screens

6.3.5 Data Entry Screens

A data entry screen can display fields like the ones shown in Figure 6-5.

- A - fields that allow you to select one of several available options.
- B - fields into which you enter numbers.

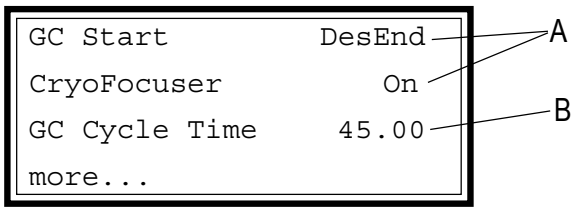


Figure 6-5 Data Entry Screen

6.3.5.1 Option Selection Fields

To review available options and select one:

1. If the cursor is on the option to be changed, press any number key to toggle the status field. Each time you press a number key, the field displays the next available option. When the desired option is displayed, press ENTER to select it. The cursor moves to the next line.
2. If the cursor is not on the option you wish to change, press ENTER to move the cursor, one line at a time. When the cursor reaches the bottom of the screen, press ENTER to move it back to the top of the screen.
3. Press any number key to toggle the status field, as described in step 1.

6.3.5.2 Data Entry Fields

To enter a number into a data entry field:

1. If the cursor is on the desired field, type the appropriate numbers in the field; then press ENTER.
2. If the cursor is not on the desired field, press ENTER to move the cursor, one line at a time. When the cursor reaches the bottom of the screen, press ENTER to move it back to the top of the screen.
3. Type the numbers in the field; then press ENTER.

6.4 Getting Started

To begin 3100 operation:

1. Turn on the 3100. (The switch is on the rear panel.) The 3100 loads program data into memory, performs initialization tasks, and briefly displays the message, "Initialization successful" on the front panel screens.
2. The screen on the front panel (Figure 6-6) shows the date and time of the last power loss.

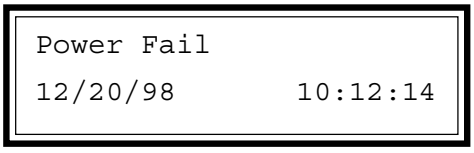


Figure 6-6 Initial Front Panel Screen

The screen on the controller (Figure 6-7 on the following page) shows the same date and time.

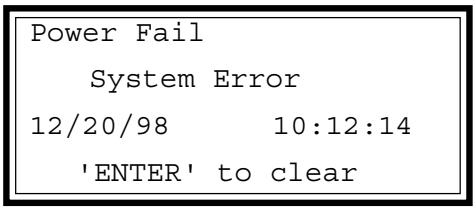


Figure 6-7 Start-up Screen

3. Press ENTER. The screen shown in Figure 6-7 appears briefly.

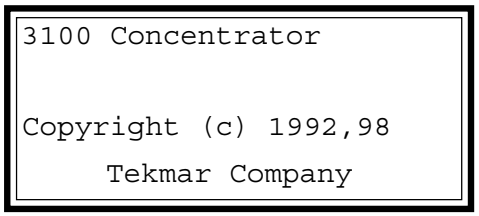


Figure 6-8 Tekmar Identification Screen

The Identification screen is followed almost immediately by the first Self Test screen (Figure 6-9).

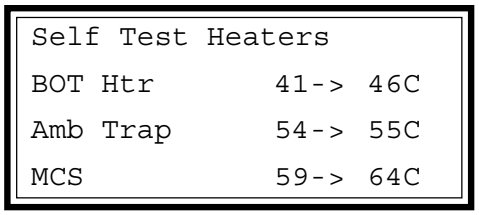


Figure 6-9 Self Test Screen 1

6.4.1 Performing Self Tests

The screen lists the heaters being tested. To test its heaters:

- The 3100 activates and establishes an incremental setpoint for each heater: 3°C above its current temperature for the valve oven heater and 5°C above current temperature for the other heaters.
- When a listed heater reaches the test temperature, it disappears from the listing. As heaters drop off the listing, the last line shows elapsed time as it progresses to a two-minute limit.

6.4.2 Exiting the Self Tests

At any point during the self tests, you can suspend self testing. When you press STEP, the 3100 displays the Self Test Status screen (Figure 6-10).

```
Self Test Status
<A> =Continue Testing
 B  =Ignore Self test
 C  =Restore Previous
```

Figure 6-10 Self Test Status Screen

The Self Test Status action screen offers three options for handling pending (uncompleted) self tests. You can:

- Press the A key to return to the previous screen and complete all pending tests.
- Press the B key to skip the pending self tests and position the unit to run the first sample of the schedule.
- Press the C key to restore previous self test results for the pending tests. This option accepts the results of the self tests that were run the last time the unit was powered up.

6.4.3 Clearing a Self Test Error

1. If a component fails to reach the setpoint within the time limit, the 3100 displays an error message on both screens. The screen on the front panel (Figure 6-11) specifies the region that failed.

```
Self test Fail
Region:         Sample
```

Figure 6-11 Front Panel Message Screen

2. The screen that appears on the hand-held controller (Figure 6-12) lists the region that failed and provides instructions for clearing the error.

```
Self Test Fail
      System Error
 12/20/98       10:30:00
    'ENTER' to Clear
```

Figure 6-12 Controller Message Screen

3. After you have corrected the problem, press ENTER to clear the error message. The 3100 displays the Reset screen.
4. Press SHIFT + RESET; the Tekmar Identification screen appears briefly, followed by the System Reset screen (Figure 6-13).

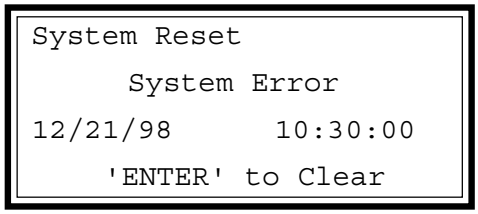


Figure 6-13 System Reset Screen

5. Press ENTER. The 3100 performs the self tests again. If you have not corrected the problem, the same region will fail again. The unit will not run until it passes the self tests.
6. When the self tests are complete, the hand-held controller displays the Standby status screen for the current method.

6.4.4 Setting the Date and Time

Use the SETUP key to establish or confirm the system clock setting.

1. From any screen, press and hold the SHIFT key; then press SETUP. The 3100 displays the Setup screen (Figure 6-14).

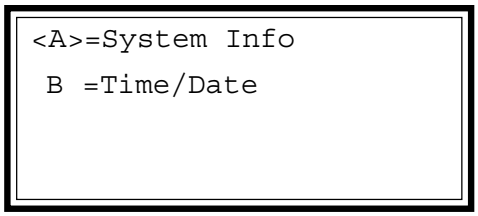


Figure 6-14 Setup Screen

2. From the Setup screen, press the B key. The Date and Time screen (Figure 6-15) appears.

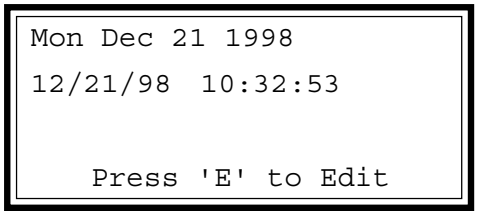


Figure 6-15 Date and Time Screen

- The first line on the Date and Time screen shows the day of the week, the month, the date and the year.
- The second line shows date (MM/DD/YY) and time (HH:MM:SS).

3. Press the E key. The Date and Time Editing screen (Figure 6-16) appears, with the cursor on the last character in the third line.

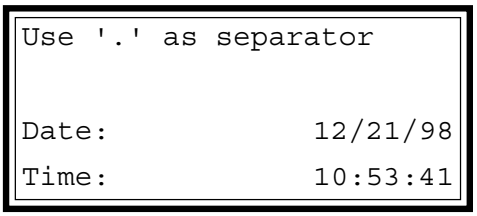


Figure 6-16 Date and Time Editing Screen

4. Type the date, using numerals to indicate month, day, and year. Use the period (.) to mark each separation between them. For example, Enter December 21, 1998 as 12.21.98. Press ENTER. The cursor moves to the end of the next line.
5. Repeat step 4 for the time line, using hours, minutes, and seconds, in military time. For example: Enter 3:13 p.m. as 15.13. Press ENTER.

6.4.5 Checking the Unit Type and ROM Version

1. From any screen, press and hold the SHIFT key; then press SETUP. The 3100 displays the Setup screen (Figure 6-14).
2. From the Setup screen, press the A key. The System Information screen (Figure 6-17) appears.

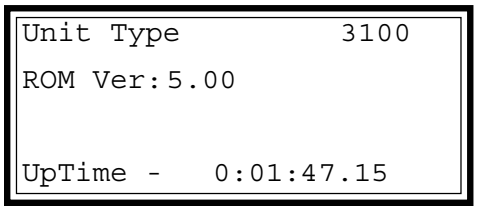


Figure 6-17 System Information Screen

- The first line gives the model number of the instrument.
- The second line shows the version of the ROM chip currently installed in the 3100.
- The last line shows the time since power up or since the last system reset.

3. After reviewing the system information, you can press STATUS to exit the System Information screen and display the current status screen.

6.5 Configuring the 3100

You can use the Configuration screen (Figure 6-18) to define essential aspects of 3100 operation. Press the CONF key to display the Configuration screen, with the cursor on the first line.

```
     Configuration
<A> = GC I/O Port
 B  = Gas flows
 C  = Installed Option
```

Figure 6-18 Configuration Screen

The Configuration screen (Figure 6-18) displays the following options:

<A> GC I/O Port - specifies the type of GC you are using.

<B> Gas Flows - indicates whether or not the sample pathway is swept with gas during the Standby step.

<C> Installed Option - indicates whether a cooling accessory is installed.

6.5.1 Specify the GC Port Type

The following sections describe the configuration options and tell you how to use them.

Note: You must specify a GC Port or the 3100 may not work with your GC.

On the Configuration screen, select the option on the first line (if necessary); the selected option letter appears with brackets (<A>). Press ENTER to display the GC Configuration screen (Figure 6-19).

```
GC Port       Standard
Handshaking         On

more...
```

Figure 6-19 GC Configuration Screen

From the GC Configuration screen, you can specify the type of GC you are using. The first line displays GC Port, a classification based on the input-output characteristics of the GC as it interacts with the 3100.

Note: The GC is interfaced to the 3100 via an interface cable, which runs from the GC to the 25-pin connector on the 3100's GC I/O card. Table 6-6 lists the available GC Port options.

Standard	A standard GC (all input and output signals from a standard GC are normally-open relay closures or TTL active-low signals)
User	The GC supplies or accepts all normally-closed relay closures, all TTL active-high signals, a combination of normally-open and normally-closed relays or a combination of TTL active-low and TTL active-high signals.

Table 6-6 Available GC Port Types

The instructions shipped with your 3100-to-GC interface cable tells you how to specify the type of GC you are using. If you do not have these instructions, refer to table 3-2 on the next pages. Find your GC and the corresponding GC Port on the table and follow the steps below. If you do not have interface cable instructions and you cannot find your GC on the table, see the next section.

1. If your GC is Standard, press ENTER to select Standard as the GC Port. The 3100 is now configured to operate with your GC. (Most GCs operate using Standard as the GC Port.) Skip the next steps and go to Section 6.5.2, Specify Handshaking.
2. If your GC is not standard, select User. Press any number key to select User as the GC Port, then press the NEXT PAGE key to display the Special GC Type screen (Figure 6-20).
3. Enter the User GC Type number. If you do not know which number to enter, find your GC on Table 6-7. Enter the number that is in the GC Type Number column.

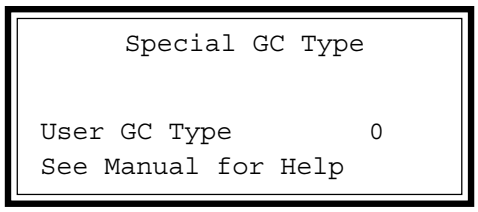


Figure 6-20 Special GC Type Screen

6.5.2 Specify Handshaking

To access the Configuration screen, press the CONF key. The second line on the Configuration screen displays the 3100-GC handshaking characteristics - whether or not the 3100 will wait for a signal from the GC (a handshake) before sending a sample. The available options are:

- On - the GC interface port operates normally.
- Off - the GC interface port operates with no input or output signals between the 3100 and the GC. The 3100 will cycle continuously.

1. Press any number key to toggle the option ON or OFF.
2. Press ENTER to accept the currently-displayed option.

6.5.3 Specify Gas Flows

To access the Configuration screen, press the CONF key. On the Configuration screen, select the option on the second line; the selected option letter appears with brackets (<B>). Press ENTER to display the Gas Flows Configuration screen (Figure 6-21).

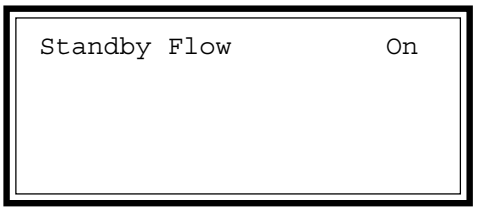


Figure 6-21 Gas Flows Configuration Screen

Tekmar Part Number for the Interface Cable	Description of the Interface Cable and the GC that it Interfaces to	GC Port	GC Type Number
14-2991-000	Hewlett-Packard 5890 GC	Standard	63
14-4830-086	2 Tekmar 2000's on one HP 5890 (GC only. 2000's must hook up to separate columns)	Standard	63
14-4188-086	Hewlett-Packard 5890 w/5970 MSD and Unix or Pascal-based software	Standard	63
14-4652-086	Hewlett-Packard 5890 w/5970 MSD and Unix-B or MS-DOS software, HP 5890/5971 MSD and Unix-B or MS-DOS software and HP 5890/5989 MS Engine	User	31
14-2993-000	Hewlett-Packard 5995/96/95/85/87/88/92 GC/MS with HP-1000/RTE GC/MS software, HP 5890 w/5970 MSD and RTE (RTE-A, RTE-6, or REV F)	User/Slave Mode Standard/Master Mode	31 63
14-2976-000	Hewlett-Packard 5710/30/90 GC w/5970 MSD with Chemstation using Quicksilver Software	User	31
14-2976-000	Hewlett-Packard 5880A/5840A	Standard	63
14-3318-000	Hewlett-Packard 5995/96/87/85/92 with Chemstation-Quicksilver	Standard	63
14-3010-000	Hewlett-Packard 5995/85/93/92 GC/MS (includes I/O box). Requires HP's BATCH or AQUARIUS software and external events relay board to operate with SIDS Data System	Standard	63
14-2968-000	Varian 3300/3400/3500/3600 with or without serial I/O and Saturn GC/MS	Standard	63
14-5044-086	2 Tekmar 2000's to one Varian 3400 GC (2000's must hook up to separate columns)	Standard	63
14-2969-000	Varian 3700	Standard	63
14-2966-000	Kit, Varian Vista (includes I/O box for switching 2000A to 2000B) also Varian 6000	Standard	63
14-2972-000	Tracor 560/565/570	Standard	63
14-2992-000	Tracor 540 and Waters Dimension I	Standard	63
14-4655-086	2 Tekmar 2000's to one Tracor 540 (GC only. 2000's must hook up to separate columns.)	Standard	63
14-3430-000	Tracor 585/9000 and Waters Dimension II	Standard	63
14-2970-000	Perkin-Elmer Sigma Series	Standard	63
14-3233-000	Perkin-Elmer 8000 Series/Autosystem	Standard	63
14-5397-086	2 Tekmar 2000's on one Perkin-Elmer 8000 Series/Autosystem	Standard	63
14-2973-000	Schimadzu GC 9A	User	31
14-4610-086	Shimadzu GC 14A/15A, GC 14A w/QP 1000 EX MSD and GC 14A w/QP 2000 MSD	User	31
14-4009-000	Splicer Cable, Finnigan 5100/4000/4500 and OWA	User	31
14-4938-086	Carlo Erba Mega/Vega Series and Fisons 8000	Standard	63
14-3147-000	General Purpose/HNU 301/321/421* * Valve driver option necessary from HNU.	Standard	63

Table 6-7 GC Port Types and User GC Type Numbers

6.5.4 Specify Installed Options

The screen illustrated above indicates that Standby Flow is turned on. This setting forces sample gas flow through the sample pathway, bypassing the sample vessel (bypass valve ON) in the Standby mode. You can shut off flow through the sample pathway by selecting the OFF option for Standby Flow. This closes the sample, bypass, and vent valves.

On the Configuration screen, select the option on the third line; the selected option letter appears with brackets (<C>). Press ENTER; the Installed Options Configuration screen appears (Figure 6-22) with the Trap Region field set to Ambient.

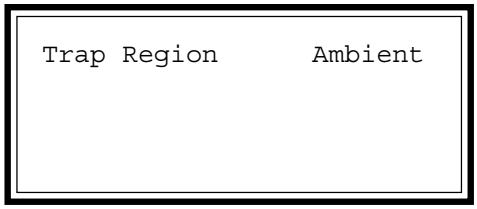


Figure 6-22 Installed Options Configuration Screen

Select one of the following values for the Trap Region field:

- Ambient - the 3100 uses the standard internal trap at ambient temperature.
- TurboCool - the 3100 operates at cryogenic temperatures with a TurboCool accessory installed.
- Cryo - this option will be included in future versions of the 3100 operating software.

6.6 Understanding Default Methods

At first power up, the 3100 is scheduled to run Method 1. The concentrator automatically performs self tests and displays the Standby screen for Method 1. When the heaters and coolers have reached the default temperature setpoints for Method 1, the hand-held controller displays a screen with the prompt, "Press START to Begin". At this point, you can:

- Press START to run Method 1 with its default parameters.
- Follow the instructions Scheduling and Running Samples to change the method schedule and run another default method.

The 3100 stores 16 methods, each with a predefined set of default parameters.

⚠ CAUTION

Temperatures above 230°C will damage Tenax traps. You may need to edit the method(s) so that the temperature will not exceed the maximum allowable temperature for your traps.

6.7 Creating Custom Methods

For each supported system configuration, the 3100 displays a different set of method editing screens. The method editing screens list the parameters associated with the operating steps for the selected method. You can create a customized method by using the method editing screens to modify parameters to meet your analytical requirements.

6.7.1 Select a Method

To edit a method, follow these steps:

- Specify the method (from 1 - 16) that you wish to change.
- Indicate the system configuration for the selected method.
- Change parameters to customize the method.

To select a method for editing:

1. Power up the system. The 3100 displays the Standby screen for Method 1.
2. Press the METH key. The 3100 displays the Method screen (Figure 6-23), with the cursor at the last position on the second line.

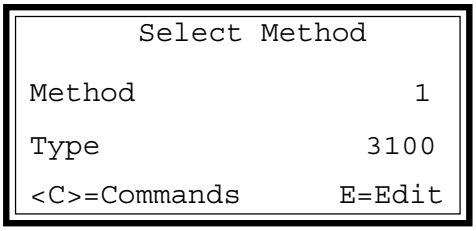


Figure 6-23 Method Screen

- Line 2 shows the number of the active method (1 through 16). The active method (the startup default) is Method 1.
- Line 3 indicates the system configuration for the currently-active method. The default type for Method 1 is 3100.

3. At the Method field, enter the number of the method to be changed; then press ENTER.

6.7.2 Indicate the System Configuration

To indicate the system configuration to be supported by the selected method:

1. Press the C key to display the Method Commands screen (Figure 6-24).

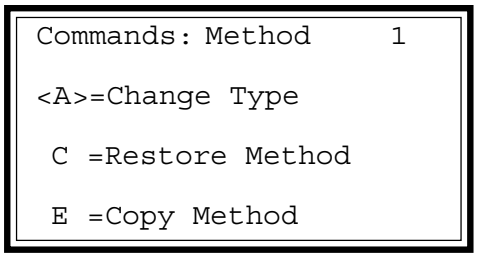


Figure 6-24 Method Commands Screen

2. Press the A key (or press ENTER when A is highlighted with <> brackets) to display the Change Method Type screen (Figure 6-25), with the cursor on the third line.

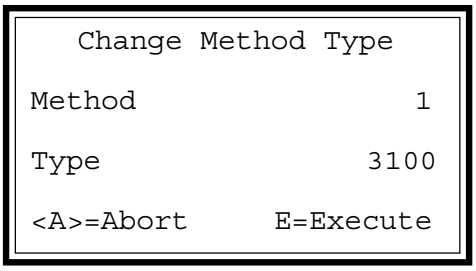


Figure 6-25 Change Method Type Screen

3. Press any number key. The value in the Type field toggles each time you press a number key. The available options are:
   - 3100 ..... Front panel sample position only.
   - 20XX ..... ALS 2016/2032 autosampler with the 3100.
   - AQUATek 50 ... AQUATek 50 with the 3100.
   - AQUATek XX . AQUATek 50 and ALS autosampler with the 3100.
   - AQUATek 70 ... AQUATek 70 autosampler with 3100
   - 60XX ..... AEROTrap autosampler with the 3100.
4. When the screen shows the correct value for the Type field, press the E key to accept the value and return to the Select Method screen.

Note: To exit the Method Commands screen without making any changes, press the A key. The 3100 ignores any changes you may have entered on the Method Commands screen and displays the Select Method screen.

6.7.3 Copy an Existing Method

If the new method will differ from an existing method in only a few parameter values, you can copy the parameters for an existing method into memory and use them as the basis for a new method.

1. On the main Method screen, press the C key to display the Method Commands screen.
2. Press the E key to display the Copying Method screen (Figure 6-26), with the cursor at the end of the second line.

```
      Copying Method

Source                  1

Destination             1

<A>=Abort     E=Execute
```

Figure 6-26 Copying Method Screen

- Line 2 shows the number of the method to be copied (Source).
- Line 3 shows the number of the method into which the Source method will be copied (Destination).

3. Type the number of the method to be copied; then press ENTER. The cursor moves to the last position on the next line.
4. Type the number of the method to receive the copy. Press ENTER.
5. Press the E key to execute the copy and return to the Select Method screen.

Note: To exit the Copying Method screen without making any changes, press the A key to abort. The 3100 ignores any changes you may have entered on the Copying Method screen and displays the Select Method screen.

6.8 Editing 3100 Methods

To begin editing the selected method, press the E key from the Method screen. For methods 1, 3, 5, 7, 9, and 11, the screen displays the sequence of editing screens for front panel sample methods (Type 3100) shown in Table 6-8.

6.8.1 Using the Editing Screens

Line Temp	150	— setpoint for transfer line
Valve Temp	150	— setpoint for the valve oven and BOT
Mount Temp	40	— setpoint for sample mount heater (optional)
MCS Line Temp	40	— setpoint for the Moisture Control System line.
Purge Ready Temp	30	— trap temperature must fall below setpoint
TurboCool Temp	-20	— setpoint for cooling the trap when a TurboCool accessory is installed.
more . . .		
Sample Heater	Off	— whether the sample heater is activated or not.
PrePurge Time	3.00	— how long the sample is swept with purge gas before being purged.
PreHeat Time	5.00	— how long the sample is heated before purge.
Sample Temp	40	— setpoint for the sample heater (optional)
Purge Time	11.00	— how long the sample is purged.
DryPurge Time	0.00	— how long the gas flows thtrough the trap, but not through the sample glassware.
MCS Des Temp	40	— setpoint for the MCS during the Desorb step
more. . .		

Table 6-8 Editing Screens for 3100 Methods

GC Start DesStart	— tells when the GC receives its START signal.
Cryo Focuser Off	— whether a Cryofocusing Module (CM) is installed.
GC Cycle Time 0.00	— length of time required for the GC to process a sample.
more . . .	
Cryo Standby 100	— temperature of the inactive CM.
CryoFocus Temp -150	— low-temperature setpoint for trapping analytes.
Inject Time 1.00	— how long the cryo heater remains at inject temp.
Cryo Inj Temp 180	— cryo heater temp. when analytes are released.
Desorb PreHeat 245	— temperature trap is heated to before trap desorb.
Desorb Time 4.00	— length of the trap Desorb step.
Desorb Temp 250	— trap temperature during the Desorb step.
Sample Drain Off	— whether automatic drain is ON or OFF.
Bake Time 10.00	— duration of the Trap Bake step.
Bake Temp 280	— trap temperature during the Bake step.
BGB On Delay 2.00	— whether Bake Gas Bypass is ON or OFF and length of BGB delay.
MCS Bake Temp 310	— MCS temperature during Bake step.

Table 6-8 Editing Screens for 3100 Methods

6.8.2 Selecting Parameters

If your analytical procedures dictate the use of parameters other than the defaults, you may modify the values to meet your analytical needs.

6.9 Moisture Control System (MCS) Parameters

The table below lists recommended parameter values for the MCS.

Desorb Flow	MCS Desorb	MCS Line	MCS Bake	Line Temp	Valve Temp
0.5-4 ml/min	50°C	150°C	310°C	150°C	150°C
7-12 ml/min	35-50°C[1]	150°C	310°C	150°C	150°C
12-20 ml/min (no split)	35°C	150°C	310°C	150°C	150°C
> or = 20 ml/min (split only)[2]	bypass[3]	35°C	35°C	150°C	150°C

Table 6-9 Recommended Parameter Values for the MCS

1 If you are looking for xylenes and heavier compounds, specify 50°C for MCS Desorb.

2 If not splitting (i.e., packed column), specify 35°C for MCS Desorb.

3 This can be achieved by using the MCS jumper - Tekmar Part Number: 14-6011-002

A Desorb Preheat temperature of 175°C and a Desorb temperature of 180°C will not efficiently release compounds that are heavier than xylenes. Use a Desorb Preheat temperature of 220°C and a Desorb temperature of 225°C (except when using the Vocarb 3100 trap) to release all compounds.

6.10 Restoring Default Parameters

You can undo changes made to default parameters for any method.

1. Press METH on the keypad.
2. At the the method field, enter the number of the method with the defaults you wish to restore; then press ENTER.
3. Press the C key to display the Method Commands screen (Figure 6-27).

```
Commands:       Method 1

<A>=Change Type

 C =Restore Default

 E =Copy Method
```

Figure 6-27 Method Command Screen

4. Press the C key to display the Restore Default screen (Figure 6-28).

```
     Restore Default

Method                  1

<A>=Abort       E=Execute
```

Figure 6-28 Restore Default Screen

5. Press the E key to execute the command. The 3100:
   - Erases any custom parameter values that have been programmed for the current method.
   - Restores the default values.
   - Returns to the Select Method screen display.

Note: To exit the Restore Default screen without making any changes, press the A key to abort. The 3100 ignores any changes or commands you may have entered on the Restore Default screen and displays the Select Method screen.

6.11 Creating a New Schedule

You must set up a method schedule, or processing timetable, to "tell" the 3100 which method(s) will be run on which sample(s). This is true regardless of whether you are using a single position unit or a unit with an autosampler attached. When you use the 3100 without an autosampler, you can specify the number and sequence of methods to be run on a single sample. When you use the 3100 with one or more autosamplers, a method schedule defines:

- The method(s) to be run.
- Start and stop positions for each method.
- A sequential order for each sample to be run.
- The number of runs per sample.

Briefly, here is how you can create and activate a method schedule:

1. Establish a desired method schedule.
2. Enter the desired schedule parameters.
3. Run the schedule.

6.11.1 Establishing a Method Schedule

Before you set up your method schedule, consider:

- The number and type of samples to be run.
- The method required for each sample.
- The preferred sequence in which to run the samples.

6.11.2 Entering Schedule Parameters

1. From any screen, press the SCHED key. The Scheduling screen (Figure 6-29) appears.

```
        Scheduling
    <A>=Sample Status
     C =Commands
     E =Edit Schedule
```

Figure 6-29 Scheduling Screen

2. At the Scheduling screen, press E to display the Schedule Editing screen (Figure 6-30), with the cursor on the first position in the Start column.

6.11.2.1 Review Default Schedule Parameters

The schedule in figure 6-30 shows the default schedule parameters for the 3100. The Schedule Editing screen has four columns and up to 12 rows.

	Start	Stop	Meth	RPS
1)	0	0	1	1
2)	0	0	0	1
3)	0	0	0	1

Figure 6-30 Schedule Editing Screen

Each row specifies:

- The number of a method to be run (in the Meth column). The default method is Method 1.
- The position of the first sample (in the Start column) and the last sample (in the Stop column) to be run according to the specified method. The default sample start and stop positions are 0, which is the number assigned to the sample that is run on the 3100.
- The number of times each sample will be run (in the RPS, Runs per Sample column).

6.11.2.2 Changing the Schedule

You can change the schedule in several ways. You can:

- Specify a different method to be run by changing the number in the Meth column.
- Specify different start and stop positions for a given method by changing the numbers in the Start and Stop columns.
- Indicate that a sample position should be run more than once by changing the number in the RPS column.

To make changes in the method schedule:

1. Type the desired parameters into each field, pressing ENTER after each entry. The cursor moves to the next field in the row. When you reach the end of a row, the cursor moves to the first field in the next row.
2. If necessary, press NEXT PAGE to display succeeding screens of Schedule Edit parameters: Rows 4-6, 7-9, and 10-12.
3. When you have entered the complete schedule, press the SCHED key to return to the Scheduling screen.

6.11.2.3 Sample Schedules

Figure 6-31 shows a typical schedule, for running two Type 20XX methods (2 and 4) on specified sample positions.

	Start	Stop	Meth	RPS
1)	1	8	2	2
2)	9	12	4	1
3)	0	0	0	1

Figure 6-31 Schedule Editing Screen

To enter this schedule:

1. On the first row, enter 1, 8, 2, and 2 in their respective columns. These entries specify that:
   - The samples in positions 1 through 8 will be run according to Method 2, with each sample being run twice.
   - Method 2 is a Type 20XX method; if you schedule position 8 for a method that has no position 8 (a Type 3100 method, for example), the 3100 displays an error message when you try to run the schedule.
2. On the second row, enter 9, 12, 4, and 1 in their respective columns. These entries specify that samples 9 through 12 will be run according to Method 4, with each sample being run through the method once.

	Start	Stop	Meth	RPS
1)	0	0	3	3
2)	0	0	0	1
3)	0	0	0	1

Figure 6-32 Sample Schedule Editing Screen

To enter this schedule:

1. On the first row, enter 0, 0, 3, and 3 in their respective columns. These entries specify that Method 3 (a 3100 method) will be run on the 3100's front panel sample. The sample will be run three times.

Note: If you are setting up a schedule to be run on an autosampler, be sure to specify methods that are the correct type for your system configuration. If you have ROM (read-only memory) version 2.10 or greater, a stop position that is less then the start position will cause the 3100 to run sample #1 on the autosampler after the last sample is run.

6.11.3 Running the Schedule

To run a schedule:

1. From the Scheduling screen, press the C key to display the Schedule Commands screen (Figure 6-33).

```
Schedule Commands
   <A>=Run Schedule
   B =Update Schedule
   C =Clear Schedule
```

Figure 6-33 Schedule Commands Screen

2. Press A (Run Schedule). The 3100 starts the current schedule and displays the Standby Status screen (Figure 6-34) for the first sample.

```
Standby          M1P01
BOT Htr       97->200C
MCS           30->100C
XferLine     150->250C
```

Figure 6-34 Standby Status Screen

During Standby, the 3100 establishes initial conditions.

6.11.4 Changing the Schedule During a Run

You can edit a schedule in the middle of a run. From the operating step Status screen press SCHED.

1. Allow the current schedule to run its course. After the 3100 completes the currently-running schedule, it automatically builds and runs the new schedule (the one you just entered). ~or~
2. Build the new schedule and run it from the beginning by following these steps:
   a. Press the SCHED key to display the Scheduling screen.
   b. Press C to display the Schedule Commands screen.
   c. Press A (Run Schedule). The new schedule is built, and the 3100 goes into Standby as it prepares to start running the new schedule.~or~
3. If your changes affect only those parts of the schedule that have not yet been run, combine the new schedule with the old and continue to run from your current position.
   a. Press the SCHED key to display the Scheduling screen.
   b. Press C to display the Schedule Commands screen.
   c. Press B (Update* Schedule). The 3100 incorporates the new schedule into the old and continues to run.

6.11.5 Restoring the Default Schedule

To restore the default schedule (Method 1 for a front panel sample on the 3100), press C (Clear Schedule) on the Schedule Commands screen..

6.12 Running a Sample

While the 3100 is operating, it shows a status screen indicating the current operating step and its active parameters. The operating steps vary, depending on the type of method you are using. This example shows the operating steps for running default Method 1.

6.12.1 Purge Ready

When all Standby setpoints have been reached, the Purge Ready screen (Figure 6-35) appears.

```
Purge Ready    M1P00

Press START to Begin
```

Figure 6-35 Purge Ready Screen

Note: If you have not yet leak checked the 3100, do so before you start a run.

Purge Ready waits for a start signal from the user (via the START key on the keypad), or from an accessory, before proceeding to the next step.

- To begin a run, press START on the terminal keypad.

The 3100 proceeds to the next step in the scheduled method. As the 3100 goes through a run, it displays a status screen for each step.

Note: You can always display a status screen by pressing STATUS on the keypad. For example, if you are editing one method while running another, you can press STATUS to review conditions for the cur-rently active operating step. You can also review this information on the 3100's front panel display.

6.12.2 Purge

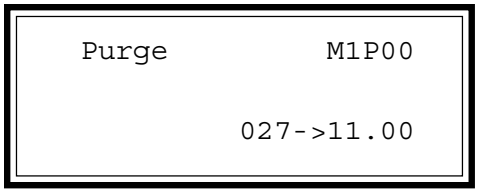


Figure 6-36 Purge Screen

The Purge step sends sample gas through the sample glassware for a specified time. The gas flow removes analytes from the sample and sends them to the internal trap.

6.12.3 MCS Cooldown

MCS Cooldown (see Figure 6-37) lowers the temperature of the moisture control system to its moisture removal setpoint. This prepares it for gas flow from the trap to the GC.

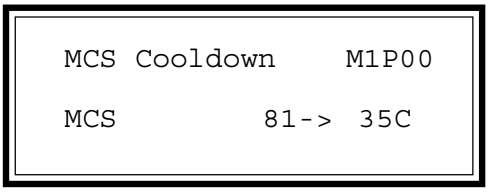


Figure 6-37 MCS Cooldown Screen

6.12.4 Desorb Ready

This step (see Figure 6-38) allows the 3100 to wait for a GC READY signal from the gas chromatograph.

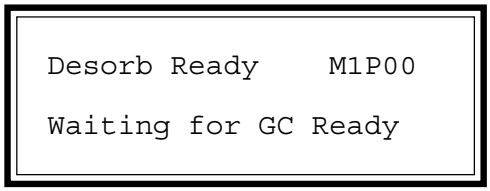


Figure 6-38 Desorb Ready Screen

6.12.5 Desorb Preheat

This step (see Figure 6-39) heats the trap to a specified temperature before desorbing analytes.

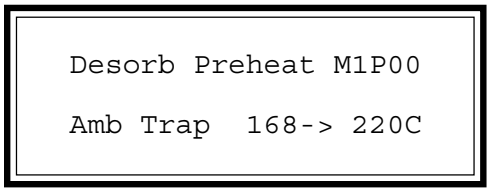


Figure 6-39 Desorb Preheat Screen

6.12.6 Desorb

This step (see Figure 6-40) backflushes the trap onto the GC (or onto the Cryofocusing Module, if installed).

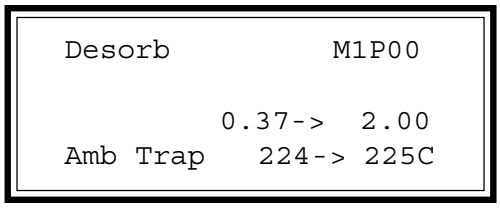


Figure 6-40 Desorb Screen

6.12.7 Bake

This step (see Figure 6-41) heats the trap and MCS; then it sends clean gas through the sample pathway to sweep it clear of residual moisture and organic contaminants.

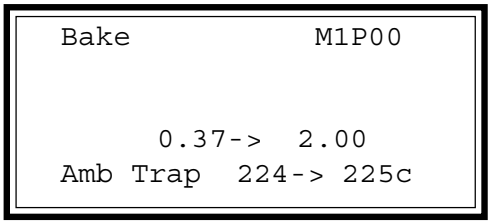


Figure 6-41 Bake Screen

6.13 Making Subsequent Runs

If the schedule calls for another run at the end of the Bake step, the 3100:

- Loads the required method into memory while displaying the screen in Figure 6-42.

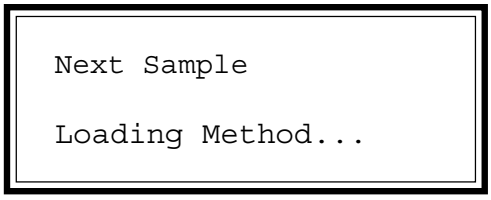


Figure 6-42 Loading Method Screen

- Displays the Standby screen while establishing initial conditions for the next run.
- Enters a GC Synchronize step (see Figure 6-43) that adds enough time to the 3100 operating cycle to synchronize it with the GC cycle. (When the 3100 is running multiple samples or multiple runs on the same sample, GC Synchronize replaces Purge Ready between runs.)

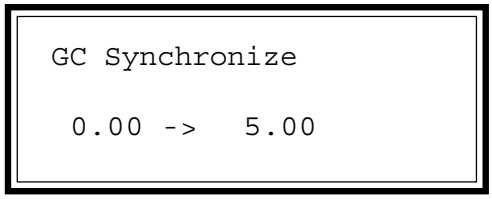


Figure 6-43 GC Synchronize Screen

- Instructs the autosampler to activate its multi-position valve and switch to the correct sample position while displaying the screen in Figure 6-44.

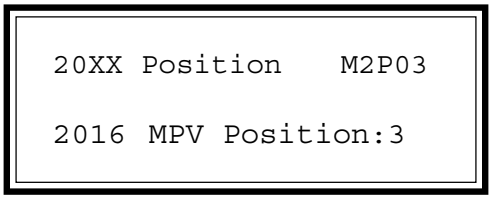


Figure 6-44 MPV Positioning Screen

6.14 Controlling Manual Operations

At any point during a run, you can display a Manual Operations screen that allows you to:

- Toggle the position of the drain valve to control the flow of liquid draining from the sample.
- Toggle the position of the vent valve to control back pressure on the sample gas feed.

To display the Manual Operations screen:

1. Press SHIFT-GO TO. The 3100 displays the screen in Figure 6-45.

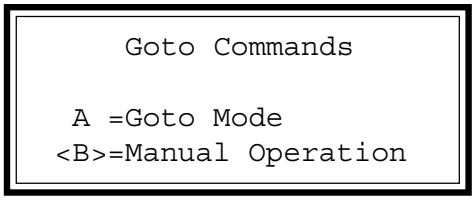


Figure 6-45 Go To Commands Screen

2. Press B. The Manual Operations screen (Figure 6-46.)

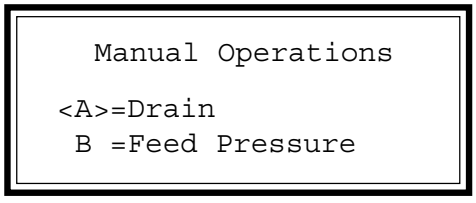


Figure 6-46 Manual Operations Screen

6.14.1 Manual Drain

The drain valve allows the sample glassware to be emptied. When it is open, liquid and gas can be forced out of the sample glassware into the drain system and out the back panel drain. If your ROM (read-only memory) version is prior to 2.10, you can drain only during Standby, Purge Ready, and Desorb.

To toggle the drain open or closed:

1. From the Manual Operations screen, press A to open the drain valve.
2. The letter D flashes in the upper right of the screen, in front of the method number.
3. To close the drain valve and turn off the flashing D, repeat step 1.

6.14.2 Feed Pressure Setting

The vent valve allows sample gas to exit the sample pathway through a front panel vent. When it is closed, pressure builds up in the sample pathway. This is used to set the feed pressure (it eliminates TPC effects). If your ROM (read-only memory) version is prior to 2.10, you can select feed pressure only during Standby and Purge Ready.

To toggle the vent open or closed:

1. From the Manual Operations screen, press B to close the vent valve.
2. P flashes in the upper right of the screen, in front of the method number.
3. To open the vent valve and turn off the flashing P, repeat step 1.

6.15 Interrupting a Run

At any point during a run, you can use control keys on the terminal keypad to:

- Change the normal sequence of operating steps,
- Abort part or all of the scheduled runs, or
- Review the current status of a method schedule.

6.15.1 Change the Normal Step Sequence

To change the normal progression through an operating sequence, you can use one of the following keys:

- Press STEP to step through an operating sequence, regardless of the setpoints for the currently-active method. Pressing STEP ends the current operating step and moves the 3100 to the next step specified in the active method.
- Press SHIFT-GOTO. The 3100 displays the screen shown in Figure 6-47.

```
      Goto Commands


<A>=Goto Mode
 B =Manual Operation
```

Figure 6-47 Go To Commands Screen

  a. Press A at the Goto commands screen to display the Goto Mode screen (Figure 6-48).

```
          Goto Mode
    <A>=Standby
     B =Desorb Preheat
     C =Bake
```

Figure 6-48 Go To Mode Screen

  b. Press A to display the Reset screen (Figure 6-49). Follow the instructions in the next section *Reset the Schedule* to select one of the Reset options and return to the Standby step.
  c. Press B to for the Desorb Preheat operating step. This prepares the 3100 to desorb the internal trap.
  d. Press C to go to the Bake operating step. This cleans out the concentrator.

- Also, to change the the normal progression through an operating sequence, press Shift-Hold. The concentrator goes into HOLD mode and does not advance to the next operating step. While the system is in HOLD, (1) the letter H flashes in the upper right corner of the screen, just in front of the method designation, (2) active timers continue to advance, allowing you to monitor the duration of a particular step, and (3) when the timer times out, the concentrator remains in the current operating step.
- Press AUTO to resume normal step progression.

6.15.2 Reset the Schedule

At any point during the running of a method schedule, you can skip or rerun the current sample, restart the schedule, or completely abort it.

- From any screen, press and hold the SHIFT key while you press RESET. The Reset screen (Figure 6-49) appears.

```
<A>=Abort Schedule
 B =Abort Sample
 C =Rerun Sample
 D =Complete & Abort
```

Figure 6-49 Reset Screen

- To restart the current method schedule, press A. The 3100 interrupts the run and returns to the Standby screen for the first sample and first method in the schedule.
- To skip the rest of a run for the current sample, press B. The 3100 interrupts its processing on the current sample, moves to process the next scheduled sample, and returns to the Standby screen for the next scheduled sample.
- To rerun the current sample, press C. The 3100 interrupts the current run, goes back to the beginning of the method to reprocess the current sample, and displays the Standby screen for the current sample.
- To reset the microprocessor to start-up status, press and hold the SHIFT key while you press RESET. The 3100 restarts and enters self-test status.
- To finish the current sample and abort the rest of the schedule, press D. The 3100 finishes the current run, goes back to the beginning of the schedule, and displays the Standby screen with the letter A flashing. The screen is shown in Figure 6-50.

```
Standby    A M01

VlvOven    104->200C
```

Figure 6-50 Standby Screen after an Abort Command

- To cancel an attempted abort:
  1. Press SHIFT-RESET on the keypad to display the Abort Schedule screen.
  2. Press D. The 3100 picks up the once-aborted schedule at the point where it was discontinued.

6.15.3 Review Current Status

You can review the currently-active schedule. When you press A from the Scheduling screen, the Schedule Status screen (Figure 6-51) appears.

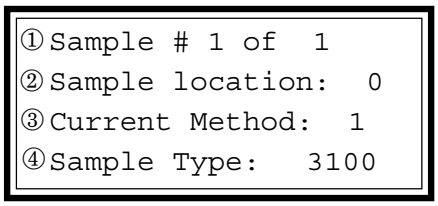


Figure 6-51 Schedule Status Screen

The Schedule Status screen is display-only; to change any parameters of the method schedule, press the SCHED key to display the Scheduling screen.

· Line 1 displays the current sample position and the total number of samples to be run according to the current method.

· Line 2 shows the location of the *currently-active* sample. (If the 3100 is running a method, the currently-active sample is being processed. If the 3100 is not running a method, the currently-active sample is the one that will be processed next.) Sample locations are:

  0 ..... the single sample location on the front panel of the 3100.
  1 to 16 ..... the sample positions on an 2016/6016 Autosampler.
  17 to 32 ... the sample positions on an 2032/6032 Autosampler.

· Line 3 lists the number of the method that is currently being run, or the method that will be run when processing starts. Method values range from 1 to 16.

· Line 4 indicates whether or not the current method includes parameters for autosamplers.The available options are: 3100 - includes parameters for the 3100 front panel single sample; 60XX, 20XX, or AQUATek 50/70, and AQUATek XX - includes parameters for an autosampler sample.

6.16 Reviewing Temperature

The Temperature screens are a multiple-screen listing of all heated zones, their current temperatures, and setpoints.

To display the Temperature screens:

- Press TEMP on the keypad. Temperature Screen 1 (Figure 7-24) appears.

```
CryoTrap  30C->  30C
Sample    30C->  30C
XferLine  98C-> 200C
BOT Htr   98C-> 100C
```

Figure 6-52 Temperature Screen

To display the next Temperature screen, press NEXT PAGE.

To display the previous Temperature screen, press PREV PAGE.

MAINTAINING THE 3100

Chapter 7

7.1 Overview

This section describes routine maintenance procedures for the 3100 and tells you how to:

- Prepare and load standards.
- Prepare and load samples.
- Install or change the trap.
- Clean and condition the trap.

7.2 Using Standards

The accuracy of your analytical results depends on the careful storage and use of accurately-prepared analytical standards. Purge and trap concentrator analyses are usually run on samples with low analyte concentrations. The low-level standards required for such analyses must be of high quality; small errors that would be insignificant in a high level standard contribute to a large percentage of error in a low-level standard.

You can purchase commercially-prepared standards. A2LA-certified solutions are produced to A2LA/EPA specifications. To ensure that a standard is certified and that it meets your specifications, ask the manufacturer. Suppliers include AccuStandard, Inc. in New Haven, CT; Chem Service Inc. in West Chester, PA; Restek in Bellefonte, PA; Supelco in Bellefonte, PA; or Ultra Scientific in North Kingstown, RI. If you do not wish to buy standards, you can prepare your own.

Because the compounds usually being analyzed for are water-insoluble and unstable in aqueous dilution, you cannot prepare an appropriate standard by dissolving the compounds directly in water. The steps commonly used to prepare methanol solutions containing known amounts of the desired compounds are listed here:

- Prepare blank (reagent, or organic-free) water.
- Prepare a standard methanol solution at the specified concentration.
- Spike the methanol standard into a flask of blank water.

7.2.1 Prepare Blank Water

Blank water is water that analyzes as organic-free when run by purge and trap analysis. You can prepare blank water in several ways,

- Pass water through a freshly-charged Millipore Super Q water purifier.
- Pass distilled water through a bed of activated carbon at least 12" deep. Put the supply vessel at a higher elevation than the collection vessel, with the supply line entering the column at the bottom. This configuration allows the water to flow from the bottom to top of the column.
- Boil water; then purge it at 80-90°C with helium or nitrogen for at least one hour.

Note: You may use either of these preparation methods, although the last two are the most common. No matter how you prepare blank water, you must check its purity by analysis before use, and you must use it immediately.

7.2.2 Prepare the Methanol Standard

To prepare a methanol standard according to USEPA-approved procedures, follow these steps:

1. Fill a 10 ml volumetric flask with about 9.8 ml of methanol. Allow the flask to stand unstoppered until all alcohol-wetted surfaces have dried.
2. Weigh the flask and its contents accurately to the nearest 100 7g; this microgram value is W_1. Using a 100 ml syringe, immediately add two drops of neat standard (minimum 75% purity) to the flask. Make sure the drops fall directly into the methanol without touching the neck of the flask.
4. Reweigh the flask with its contents; this microgram value is W_2.
5. Dilute the solution to volume (V_C in milliliters) with methanol; then stopper the flask and invert it several times to mix the solutions.
6. Calculate the concentration in micrograms per milliliter $(W_2 - W_1)/V_C$.
7. Transfer the solution to a 10 ml screw cap bottle with a Teflon cap liner, and store it at 6°C.

Methanol solutions containing 2-chloroethyl vinyl ether are stable for one week. Other solutions prepared in this way are stable for up to four weeks. You can vary the methanol dilution to provide a range of standards.

7.2.3 Prepare the Aqueous Standard

Prepare aqueous standards immediately before analysis. When you are ready to run an aqueous standard:

- Spike a measured quantity of the methanol standard into a 100 ml volumetric flask filled with blank water; or
- Spike a measured quantity of the methanol standard through a microliter syringe into the luer fitting of the sample syringe.

Note: Do not inject more than 20 ml of methanol into 100 ml of water.

7.3 Preparing Samples

Before you make an analytical run, you must select an appropriate sample size and load the selected sample.

7.3.1 Select a Sample Size

Sample size depends on many factors: the physical state and homogeneity of the sample; the concentration and vapor pressure of target compounds; the type of detector used, desired detection limits, and the type of GC column. Size has a major effect on the accuracy of the analysis because:

- Capillary columns require small samples (or split injection) to avoid column overloading.
- Sensitive detectors (like electron capture) require small samples to avoid saturation.
- Less volatile compounds or compounds present in low concentration require larger samples to be detected accurately, although they can overload columns and saturate detectors.

For samples of unknown concentrations, Tekmar recommends that you start small (at 0.25 mg for solids and 0.5 ml for liquids) and increase as needed. It is usually easier to optimize results by increasing sample size rather than decreasing it.

7.3.2 Load a Sample

You can load samples in either of two ways:

- For solid samples, remove the sample glassware, insert the sample, weigh it in the glassware, and reinstall the glassware.

> ⚠ **CAUTION**
>
> **If Auto Drain is on and you use U-shaped glassware to run a solid sample, you will damage the instrument.**

- For aqueous samples, use a luer-lock syringe to load the sample through the sample valve without unloading the glassware. Follow these steps:

1. Remove the plunger from the syringe barrel.
2. Carefully pour the sample into the barrel until the sample overflows.
3. Insert the plunger and vent any air while adjusting the plungeR to the desired volume.
4. Turn the arrow on the valve stem so that it points toward the syringe. (At other times, when a sample is not being loaded, the arrow on the valve stem should point to the left.)
5. Insert the syringe and load the sample through the sample valve.

> ⚠ **CAUTION**
>
> **Load only aqueous samples through the sample valve.**

7.4 Working with Traps

The 3100 is delivered with a blank trap installed. This prevents damage to a packed trap if the instrument was powered up with no purge gas flow present. You must replace the blank trap with a packed trap before you run a sample.

7.4.1 Information on Traps and Adsorbents

Traps can be identified by a number stamped on the nut at the top of the trap. Table 7-1 on the following pages gives detailed information about traps and how to use them.

Trap #	What Adsorbents are in it	What it Traps	Can it be Dry Purged?	Dry Purge Time	Desorb Preheat Temp.	Desorb Temp.	Bake Temp.	Bake Time	Cond. Time & Temp. for New Traps	Common Problems with Trap
1	Tenax	Everything from methylene chloride and heavier	Yes	4-6 min.	220°C	225°C	230°C	7-10 min.	225°C 180 min.	Low response on brominated compounds, a high back pressure, an outgassing of benzene, toluene and ethyl benzene
2	Tenax Silica Gel	Everything except freons	No	N/A	220°C	225°C	230°C	10-12 min.	225°C 180 min.	Low response on brominated compounds, a high back pressure, an outgassing of benzene, toluene and ethyl benzene
3	Tenax Silica Gel Charcoal	Everything including freons	No	N/A	220°C	225°C	230°C	10-12 min.	225°C 180 min.	Low response on brominated compounds, a high back pressure, an outgassing of benzene, toluene and ethyl benzene
4	Tenax Charcoal	Traps everything except gasses	No	N/A	220°C	225°C	230°C	7-10 min.	225°C 180 min.	Low response on brominated compounds, a high back pressure, an outgassing of benzene, toluene and ethyl benzene
5	OV-1 Tenax Silica Gel Charcoal	Everything including freons	No	N/A	220°C	225°C	230°C	10-12 min.	225°C 180 min.	Low response on brominated compounds, a high back pressure, an outgassing of benzene, toluene and ethyl benzene

Table 7-1 Information on Traps and Adsorbents

Trap #	What Adsorbents are in it	What it Traps	Can it be Dry Purged?	Dry Purge Time	Desorb Preheat Temp.	Desorb Temp.	Bake Temp.	Bake Time	Cond. Time & Temp. for New Traps	Common Problems with Trap
6	OV-1 Tenax Silica Gel	Everything except freons	No	N/A	220°C	225°C	230°C	10-12 min.	225°C 180 min	Low response on brominated compounds., a high back pressure, an outgassing of benzene, toluene and ethyl benzene
7	OV-1 Tenax	Everything from methylene chloride and heavier	Yes	4-6 min.	220°C	225°C	230°C	7-10 min.	225°C 180 min.	Low response on brominated compounds., a high back pressure, an outgassing of benzene, toluene
8	Carbopak B Carbosieve S III	Everything including freons	Yes	11 min.	245°C	240°C	260°C	4-10 min.	260°C 90 min.	Loss of carbon tetrachloride. Trap may need up to 11 min. of dry purge time to remove water.
Supelco Vocarb 4000	Carbopak C Carbopak B Carboxen 1000 Carboxen 1001	Everything except 2-chloro-ethyl vinyl ether	Yes	1-3 min.	245°C	250°C	260°C	10 min.	270°C 120 min.	High backpressure and a low response on chlorinated compounds

Table 7-1 Information on Traps and Adsorbents

Trap #	What Adsorbents are in it	What it Traps	Can it be Dry Purged?	Dry Purge Time	Desorb Preheat Temp.	Desorb Temp.	Bake Temp.	Bake Time	Cond. Time & Temp. for New Traps	Common Problems with Trap
Supelco's Vocarb 3100	Carbopak B Carboxen 1000 Carboxen 1001	Everything including freons	Yes	1-3 min.	245°C	240°C to 250°C	260°C	4 min.	270°C 120 min.	Decomposition of bromoform can occur. To prevent this from happening, reduce Desorb temp. to 240°C
Alltech Tenax GR Graphpac-D	Tenax GR Graphpac-D	Everything including freons	Yes	1-4 min.	245°C	250°C	260°C	12 min.	_____ 120 min.	Unknown
Supelco's BTEX	Carbopak B Carbopak C	Everything down to benzene (It does not trap MeOH)	Yes	1-3 min.	245°C	250°C	260°C	4 min.	270°C	Unknown

Table 7-1 Information on Traps and Adsorbents

7.4.2 How to Change a Trap

WARNING

Make sure the trap is cool before you touch it.

To remove the trap:

1. Turn off and unplug the 3100.
2. Loosen the two screws on the 3100's right front panel. Slide the right-front panel forward and then to the right to remove it.
3. Loosen the nut at the bottom of the trap one full turn, but do not remove it completely. (It contains a two-piece Teflon 1/8" ferrule.) If loosening it by hand is not possible, use a 3/8" wrench to hold the bottom fitting in place. Use another 3/8" wrench to turn the nut at the bottom of the trap counterclockwise until the fitting is disengaged. If the nut at the top of the trap does not loosen easily, the ferrule may be deformed and need replacement.
4. Use a 3/8" wrench to turn the nut at the top of the trap clockwise (toward you) until the fitting is disengaged. The top of the trap is designated by a 1/8" gold-plated Valco ferrule.

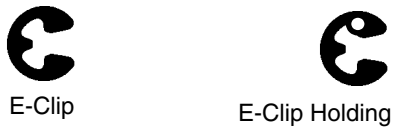
CAUTION

Do not use a Teflon ferrule at the top of the trap. The trap has a one-piece gold-plated ferrule that is preswaged onto the trap. Carryover and contamination may occur if you use a Teflon ferrule at the top.

5. Push the trap down and out of the top fitting; then carefully pull the trap straight up and out of the lower fitting and furnace assembly.

CAUTION

An E-clip should be installed at the bottom of the trap tokeep the trap from sliding down. If the trap slides down, a cold spot will be created at the top of the trap; the cold spot can hold up heavy compounds and cause lower and inconsistent response.



E-Clip E-Clip Holding the Trap

Figure 7-1 E-clip

To install a trap:

1. Slide a packed trap into the trap furnace sleeve from the top, making sure that the one-piece gold-plated ferrule is at the top of the trap. When installed correctly, the ferrule may be free to spin axially on the tubing, but should have no lateral movement along the tubing.
2. Finger-tighten the top of the trap counterclockwise. While tightening the top, push up on the bottom of the trap so that it is seated all the way up in the top fitting. To prevent gas from leaking at the fitting, use an open end wrench to tighten the nut 1/4 turn (90°) past the point where the ferrule first starts to grab the tubing. Do not overtighten; too much force will damage the ferrule, causing leaks.

   If turning the nut 1/4 turn fails to eliminate a leak at the top of the trap, look for other possible causes. Make sure that the correct size nut and ferrule are installed properly. (See Step 1.) Also, examine the parts for fractures or deformities. If there are no flaws in the parts or installation, gradually tighten the nut in increments of 1/16 turn only. Do not risk damaging the ferrule; if a leak problem persists, call Tekmar-Dohrmann Service.
3. If the bottom 1/8" Teflon ferrule needs to be replaced, remove the nut and ferrule. Slide the bottom nut on the new trap. Then slide the two-piece Teflon ferrule onto the trap (with the cone side down).
4. Finger-tighten the bottom trap. (While tightening, push the trap up from the bottom fitting to make sure the trap is completely nested in the bottom of the trap fitting.)
5. Use a 3/8" wrench to tighten the fitting 1/16 turn past finger-tight. Do not overtighten; excess force will damage the ferrule.

Trap lifetimes range from two weeks to five years, with the average being approximately six months. Tenax has a significantly shorter lifetime than silica gel or charcoal. Silica gel and charcoal normally do not affect trap longevity.

7.4.3 When to Replace a Trap

Indicators of trap wear are:

- Increase in background. This usually takes the form of benzene and other aromatics in instrument blanks.
- Losses of brominated compounds while other compounds are constant.
- Increase in back pressure.

7.4.4 Conditioning a Trap

You condition a trap by heating (baking) it in the 3100. The conditioning time and temperature can vary, depending on the type of trap you are using. To find out the correct conditioning time and temperature for a new trap, see Table 7-1, check with the trap manufacturer or call Tekmar-Dohrmann Service at (800) 543-4461 or (513) 247-7000.

If organic solvents are present in the ambient atmosphere, Tekmar recommends that you condition the trap for 10 minutes at 225°C at the start of each day. This time and temperature are usually adequate for silica gel and charcoal traps. However, if the trap is heavily loaded or if you are running samples containing compounds of low volatility, you may have to bake the trap longer than 10 minutes. Keep in mind that temperatures above 225°C do not necessarily speed up conditioning and can damage Tenax traps.

To condition a trap:

1. Check the Method. The Bake temperature should be the correct temperature for conditioning the trap.
2. Press SHIFT-GO TO.
3. Press the A key (Go to Mode).
4. Press the C key (Bake).
5. Press SHIFT-HOLD to keep the 3100 in Bake mode for the proper amount of conditioning time.

7.5 Cleaning Sample Lines

The 3100 may become seriously contaminated from a highly concentrated sample or a poor quality gas supply. To avoid contamination, keep the sample lines clean.

To remove sample-caused contamination:

1. Turn Bake Gas Bypass (BGB) OFF and install clean, dry glassware.
2. Press SHIFT-GO TO. Press the A key (Go To Mode). Press the C key (Bake). Press SHIFT-HOLD.
3. Keep the unit in Bake mode for at least 1 hour. In some cases, longer durations might be required.

If baking does not remove contamination, you may want to backflush the lines with the Tekmar-Dohrmann Solvent Flush Kit (P/N 14-5118-100). Call Tekmar-Dohrmann at (800) 874-2004 or (513) 247-7000 to order.

To remove contamination resulting from the use of poor quality gas:

1. First replace the tank and all hydrocarbon traps on the gas supply line. This process may be sufficient to obtain good blanks. If not, press SHIFT-GO TO. Press the A key (Go To Mode). Press the C key (Bake). Press SHIFT-HOLD.
2. Keep the 3100 in Bake mode for at least 1 hour. In some cases, longer times might be required. If the contamination problem persists, call Tekmar-Dohrmann's Service Department for assistance.

7.6 Cleaning Glassware

Clean glassware is essential to interference-free runs. This applies to flasks and cylinders as well as samplers (that is, any vessel used to handle samples, standards, blank water, etc.)

To clean glassware, Tekmar-Dohrmann recommends that you use the following:

- Dedicated glassware
- Ultrasonic bath
- Muffle furnace

Dedicated glassware refers to glassware that is used for concentrator work only. Glassware that is used for other procedures such as extractions, often is not clean enough to use in trace applications.

An ultrasonic bath is a time-saver. Instead of heavy scrubbing, a brief scrubbing followed by ultrasonics is more effective and less work.

Ultrasonic baths can clean the frits and walls of frit samplers that brushes cannot reach. It is acceptable to use any glassware detergents that are recommended for use in an ultrasonic bath. (We recommend that you use the Tekmar-Dohrmann Ultrasonic Bath.)

A muffle furnace is excellent for cleaning many samplers that nothing else can touch. Set the temperature to approximately 350-400°C (do not go too high; the glassware may melt) and allow the residues to be oxidized. After the glassware has cooled, you can easily remove the remaining char with a brush and cleaning agent. (We recommend the Tekmar™ Muffle Furnace.)

7.7 Cleaning the Sample Needle

You must clean the sample needle on a routine basis. Frequency of cleaning depends on the kind of samples you are running. If you are running aqueous samples, you do not need to clean the sample needle very often. If you are running oils and other messy samples, you must clean the needle after every run.

To clean the sample needle:

1. Wash the needle with Alconox detergent (or equivalent) and water.
2. Rinse well with blank water.
3. If the needle does not get clean, bake it for about two hours at 65°C (149°F).

USING TURBOCOOL WITH THE 3100

Chapter 8

8.1 Overview

This section describes how to use TURBOCool with the 3100. To install TURBOCool on the 3100, see the installation instructions shipped with the TURBOCool assembly kit. Also refer to the parts diagram at the end of this chapter.

8.2 Description

TURBOCool, an optional accessory to the 3100, uses liquid CO_2 (carbon dioxide) to permit purging onto a subambient trap. TURBOCool can be installed into the 3100 in one of the following ways:

- By factory personnel before the 3100 is shipped
- By a Tekmar-Dohrmann Field Service Representative
- By ordering an installation kit and doing it yourself

The 3100 with TURBOCool is built the same as the 3100 without TURBO-Cool except for:

- A special trap furnace that is inserted into a chamber assembly
- The addition of a 12 VDC coolant valve
- The addition of a bulkhead at the rear of the 3100

The special trap furnace is inserted into an expansion chamber assembly.

Then it is connected to the top and bottom trap fittings.

The 12 VDC coolant valve is mounted underneath the MCS (Moisture Control System). It plugs into the connector labeled "A" on the power supply/output card.

The bulkhead, which provides connections for tubing, is mounted to the inlet vent on the rear of the 3100. Coolant flows from the supply cylinder to the 3100 through the tubing.

More detailed installation instructions are shipped with the TURBOCool assembly kit.

Liquid CO_2 enters the expansion chamber in the TURBOCool accessory and spirals downward; it expands and creates a vortex of dry ice on the outside of the trap. (see Figure 8-1.) The vortex maintains the trap at a uniform temperature during the purge cycle. This minimizes breakthrough and improves resolution of the lighter, early eluting gases in gas chromatography. It does this by rapidly cooling the adsorbent trap to a controlled temperature (230°C to -20°C). The trap cooldown time is less than 25 seconds.

The standard liquid CO_2 supply cylinder will provide approximately 45-120 runs with TURBOCool, depending on the application. You can conserve liquid $C0_2$ by allowing the concentrator fans to cool the trap for a while after the bake cycle. Then you can use the liquid $C0_2$ to bring the temperature down to the desired level.

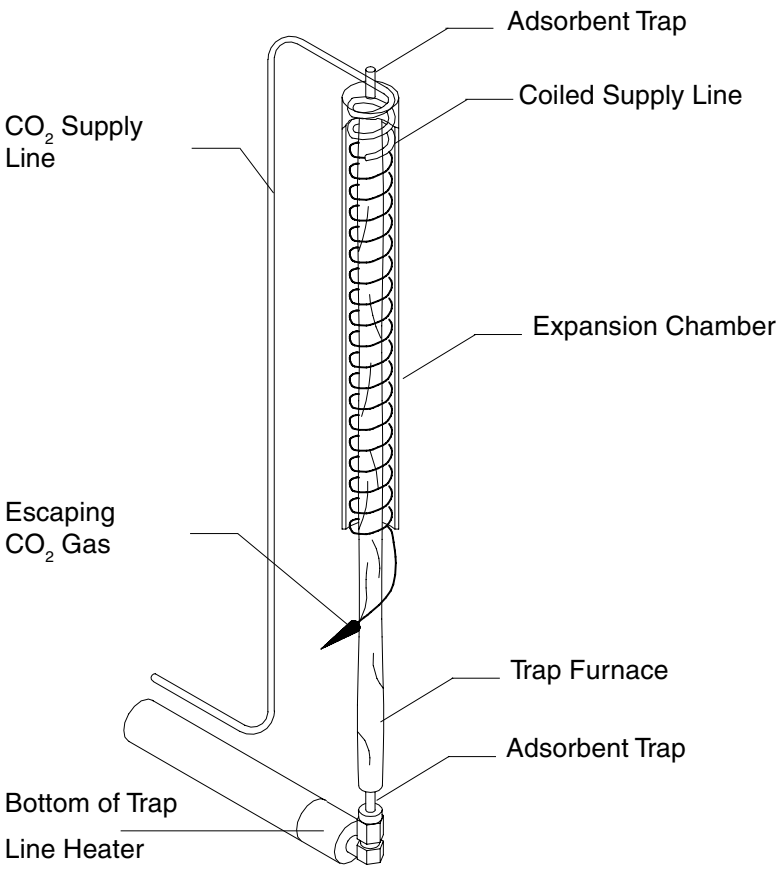


Figure 8-1 TURBOCool Operation

8.3 Applications

Broad, jagged, and poorly resolved peaks are a common result of the permanent gases that are extremely volitile (dichlorodifluoromethane, chloromethane, vinyl chloride, bromomethane, chloroethane and trichlorofluoromethane) and rapidly migrate through the adsorbent trap on the concentrator. This results in minimal interaction between the analytes and the trap sorbent, leaving a broad band of analytes to enter the chromatographic column. Broad, jagged, poorly resolved peaks are a common result.

TURBOCool improves chromatographic performance in two ways:

- First, it cools the trap to a preset temperature; this increases reproducibility because the trap stays at the same temperature for each analysis.
- Second, at subambient temperatures, the purged analytes stay focused in a narrow band on the trap. When the trap is quickly heated and backflushed in the desorption mode, the compounds stay in a tight band as they deposit on the head of the column. This results in better peak shape, resolution, sensitivity, and reproducibility of the permanent gases. See the sample chromatograms.

You can use TURBOCool in conjunction with a low volume insert or your GC injection port to permit GC-direct injections. TURBOCool also improves purge and trap gas chromatography when using different column geometries.

8.4 Specifications and Safety

This section gives you specifications and safety information for TURBOCool.

Furnace: -20°C to 375°C. On newer furnaces, rise rate is approximately 700°C/min.; on older furnaces, it is approximately 200°C/min.

Traps: Uses existing Tekmar™ concentrator traps (stainless steel standard):

Length:	12"
Outer Diameter:	0.123" + or - 0.002"
Wall Thickness:	0.010"

Valving: 12 VDC, liquid CO_2 valve, 1000 psi rated

Electronic Control: Via 3100 circuitry and software

Tubing: 1/8" liquid CO_2 supply line, standard 1/8" compression fitting

WARNING

To avoid electrical shock, turn off and unplug the 3100 before installing or servicing the TURBOCool accessory.

WARNING

TURBOCool requires a SUPPLY of high pressure liquid $C0_2$ (carbon dioxide) with inductor tube. Do not allow the SUPPLY pressure to exceed 1000 psi.

CAUTION

TURBOCool temperatures range from extreme highs to lows. To avoid injury, avoid touching hot or cold surfaces. Keep protective covers in place.

CAUTION

Operate TURBOCool in a well ventilated area to prevent saturation of the ambient air with carbon dioxide.

8.5 TURBOCool and Operating Cycle Times

Some time after the 3100 completes the Bake step, it enters the Turbo Cooldown step. During this step, the TURBOCool trap cools to its low temperature setpoint for trapping analytes. The GC cycle time (GC run time plus cooldown time) determines when the Turbo Cooldown step begins. For example, suppose the time to complete one GC cycle is 40 minutes and the time to complete one 3100 cycle is 35 minutes. To coordinate the GC cycle time with its own cycle time, the 3100 waits five minutes after the end of Bake before advancing to Turbo Cooldown. The 3100 calculates the length of the delay (up to 1000 minutes), based on the GC cycle time. This waiting period is called the GC Synchronize step. This step not only provides smooth coordinated operation, it also conserves CO_2 by not allowing Turbo Cooldown to start too soon.

If the GC cycle time is less than the 3100 cycle time, the 3100 will step directly into Turbo Cooldown after bake.

If you have installed a TURBOCool accessory and are running multiple samples, the GC Synchronize step replaces Purge Ready between runs.

8.6 TURBOCool Method Parameters

Two method parameters are associated with TURBOCool:

- TURBOCool Temperature
- GC Cycle Time

The TURBOCool temperature, which is analyte-specific, is the temperature of the TURBOCool trap. Choose a cooldown temperature that is recommended by the USEPA (United States Environmental Protection Agency).

Program the 3100 to cool the TURBOCool trap to a certain temperature by:

- using a default method that includes the desired temperature.

  or

- editing your own, customized method.

The time at which the 3100 advances to Turbo Cooldown mode is based upon operating cycle times. (See the previous section).

To determine GC cycle time:

1. monitor the time it takes for the GC to cool from its bake temperature to starting temperature.
2. add this time to the GC run time.

Program the 3100 to recognize the GC cycle time by:

- using a default method that includes the desired GC cycle time.

  or

- editing your own, customized method.

The 3100:

1. determines the time needed to complete its modes of operation.
2. subtracts this time from the GC cycle time.
3. uses this quantity to determine the time at which the CO_2 valve activates and Turbo Cooldown begins.

8.7 Ordering Parts or Obtaining Service

This section lists replacement parts for the TURBOCool accessory.

To order parts, ask technical questions, or obtain service, call one of the following numbers:

- (800) 543-4461 - toll-free in the US and Canada
- (513) 247-7000 - outside the US and Canada

Before you call for service or parts:

1. Note the model name, model number, and serial number of the 3100.
2. If requesting assistance or service, note the type of problem you are having: write down the conditions under which the problem occurred and the display, activity, or result that indicated the existence of a problem.
3. When ordering parts, write down the part number, part name, and quantity needed.

14-5763-100	TURBOCool assembly kit
14-5717-120	Trap heater, TURBOCool, 3100
14-5678-016	Elbow, 1/4" - 1/4", brass
14-5634-400	Power lead, cryo valve, 25" long
14-5582-179	Assembly, chamber, expansion
14-5467-022	Clamp, 3/4" dia.
14-4812-016	Union, reducing, 1/2" - 1/4"
14-4811-016	Flare nut, short, 1/2 OD
14-4810-002	Tubing, 1/2" OD, 2" long, copper
14-3268-046	Spacer, #6 x 1/4" long, 1/4" OD, alum
14-3105-186	Cable assembly, cryo to LN_2 valve
14-2531-100	Valve assembly, LN2, light grey
14-1652-004	Insulation, pipe, 3/8" ID x 1/2" W
14-1313-002	Tubing, copper, 1/4" dia., raw
14-1070-004	Insulation, varglass, type H, 3/4 natural
14-0485-109	Washer, lock int. tooth, #6
12-0388-030	Heat shrink, 3/4, black
12-0325-210	Nut, hex, 6-32, SS
12-0323-C01	Screw, #6-32 x 1/2, pan head
12-0317-407	Grommet, 0.625 ID, 0.937 mount hole

TROUBLESHOOTING THE 3100

Chapter 9

9.1 Overview

This section gives you basic troubleshooting information.

This chapter is divided into four parts:

- Calling Tekmar-Dohrmann Service
- Safety
- Troubleshooting Electomechanical Problems
- Understanding Error Screens

9.2 Calling Tekmar Dohrmann Service

If you need assistance solving a problem, follow these steps:

1. Note the model name, model number, and serial number of the instrument.
2. Note the type of problem you are having: write down the conditions under which the problem occurred and the display, activity, or result that indicated the existence of a problem.
3. Call Tekmar-Dohrmann Service at one of the following numbers:

- (800) 874-2004 - toll-free in the US and Canada
- (513) 247-7000 - outside the US and Canada

9.3 Safety

Before you troubleshoot, please read the safety information in this section.

⚠ CAUTION

Unless the pneumatic lines are badly contaminated, do not flush them with a strong solvent, such as methanol; use water instead. The valve rotor can adsorb strong solvents and become contaminated. If you must use a strong solvent, rinse the lines thoroughly with water after cleaning them.

DANGER

Do not service a Tekmar instrument if you are not qualified to do so. Call Tekmar-Dohrmann Service.

Disconnect power before replacing parts.

Do not redesign or modify the equipment in any way. Do not remove equipment grounds. Never replace a fuse with one of a higher rating. Always use the correct replacement parts.

Assume that high current and voltage are on ALL circuits.

Do not place liquids near the area where you are troubleshooting; liquids can spill on live circuits and conduct electricity.

Jewelry conducts electricity; remove jewelry.

Use insulated tools.

Capacitors on electronic circuit boards can hold an electrical charge even after you turn off the unit. Do not touch the capacitors.

Do not troubleshoot when you are tired or taking medication that makes you drowsy.

Work in a well-lighted area.

Do not work alone.

Wear safety glasses.

Follow the manufacturer's directions when using solvent and other chemicals. They may ignite, explode or damage the equipment. Also refer to MSDS (Material Safety Data Sheets) for safety information.

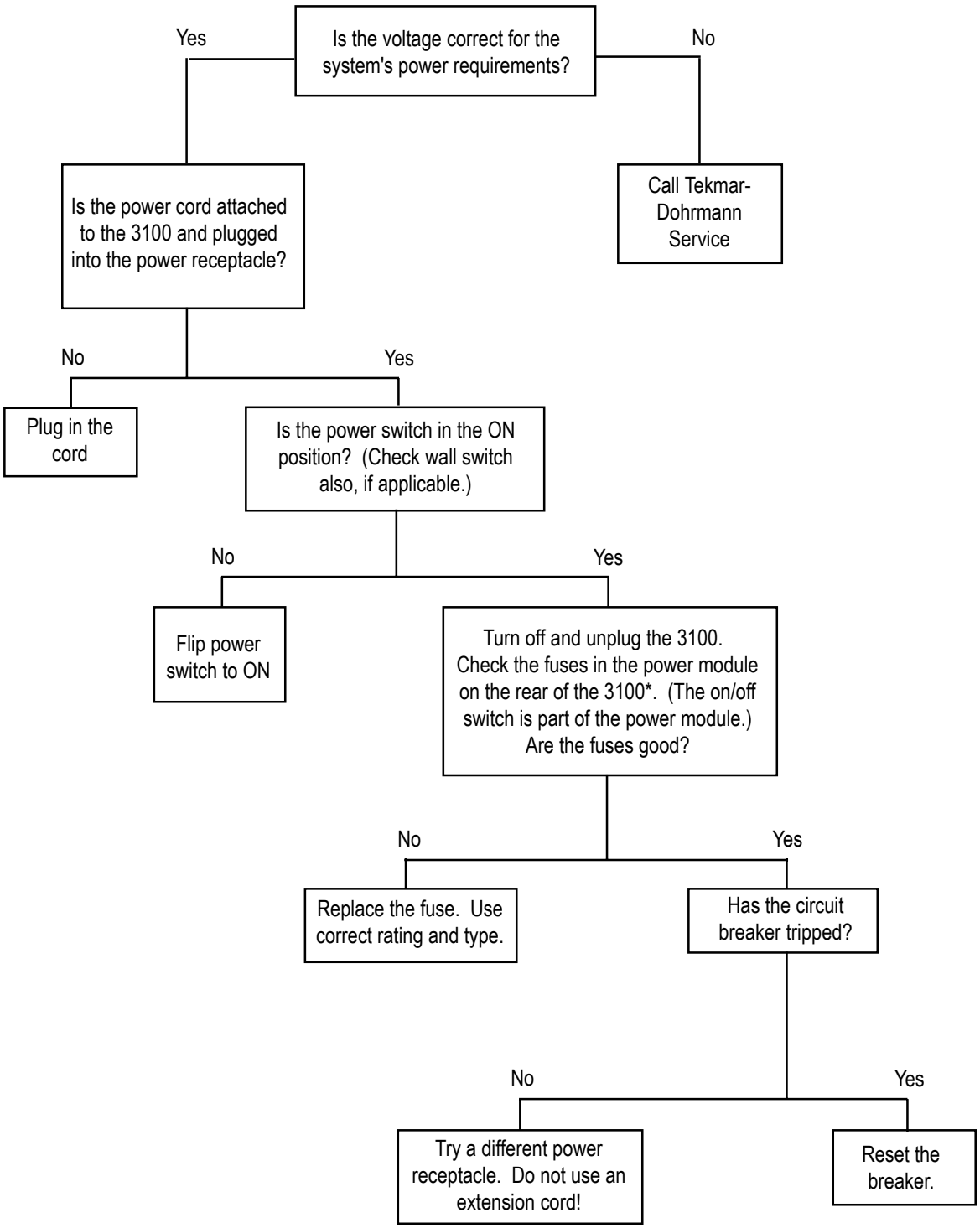
Place a fire extinguisher nearby that is rated for electrical and chemical fires.

Internal parts (especially heaters, heat sinks and some electronic components) can get very hot. When troubleshooting, be careful not to touch these parts. Allow parts to cool before replacing them.

Some Tekmar accessories require the use of liquid CO_2 (carbon dioxide) or LN_2 (liquid nitrogen). These chemicals produce low temperatures that can damage human tissue. Avoid touching the chemicals or the surfaces that they cool.

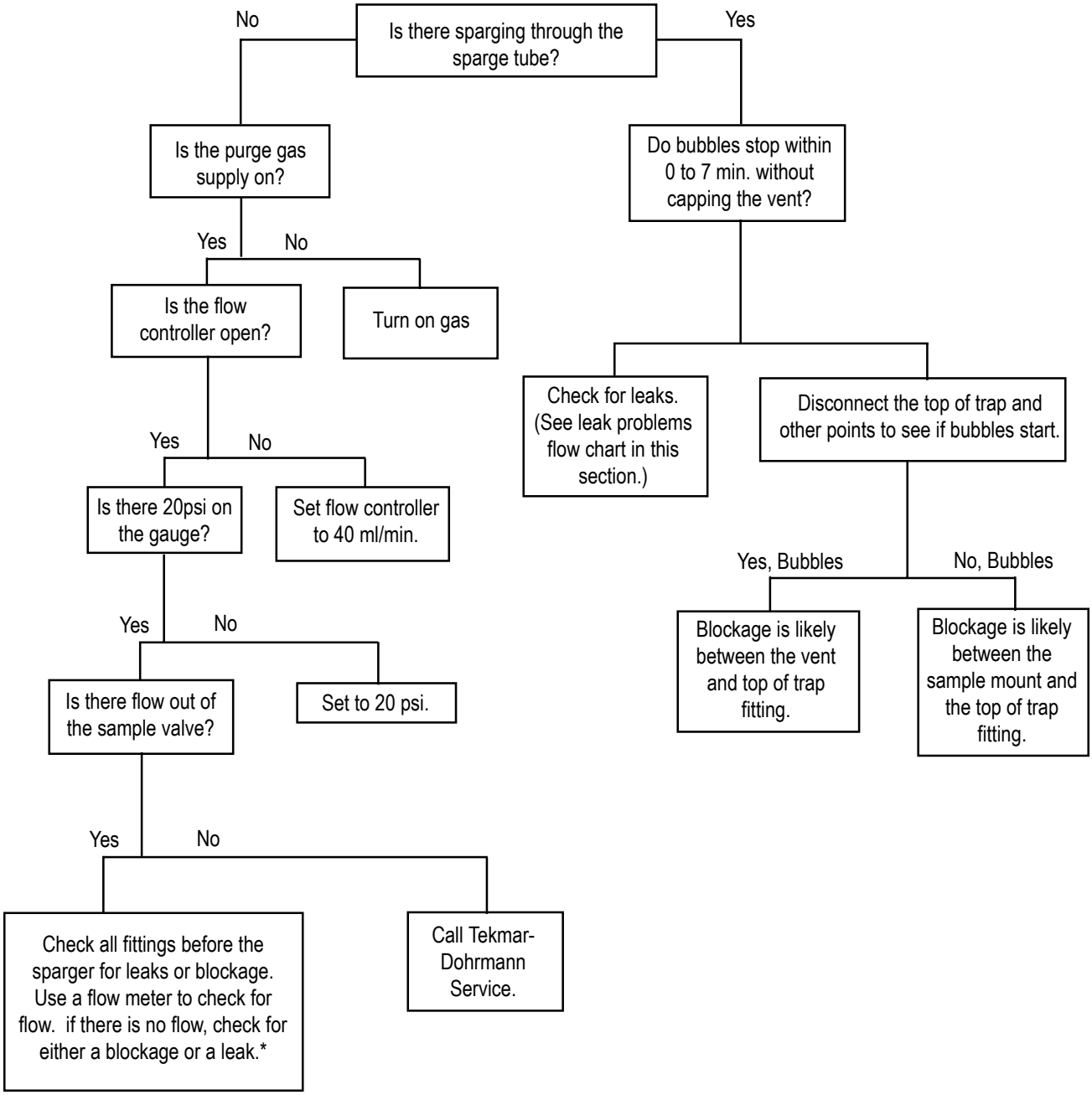
Do not exceed maximum pressure ratings for Tekmar instruments.

No Power to the 3100



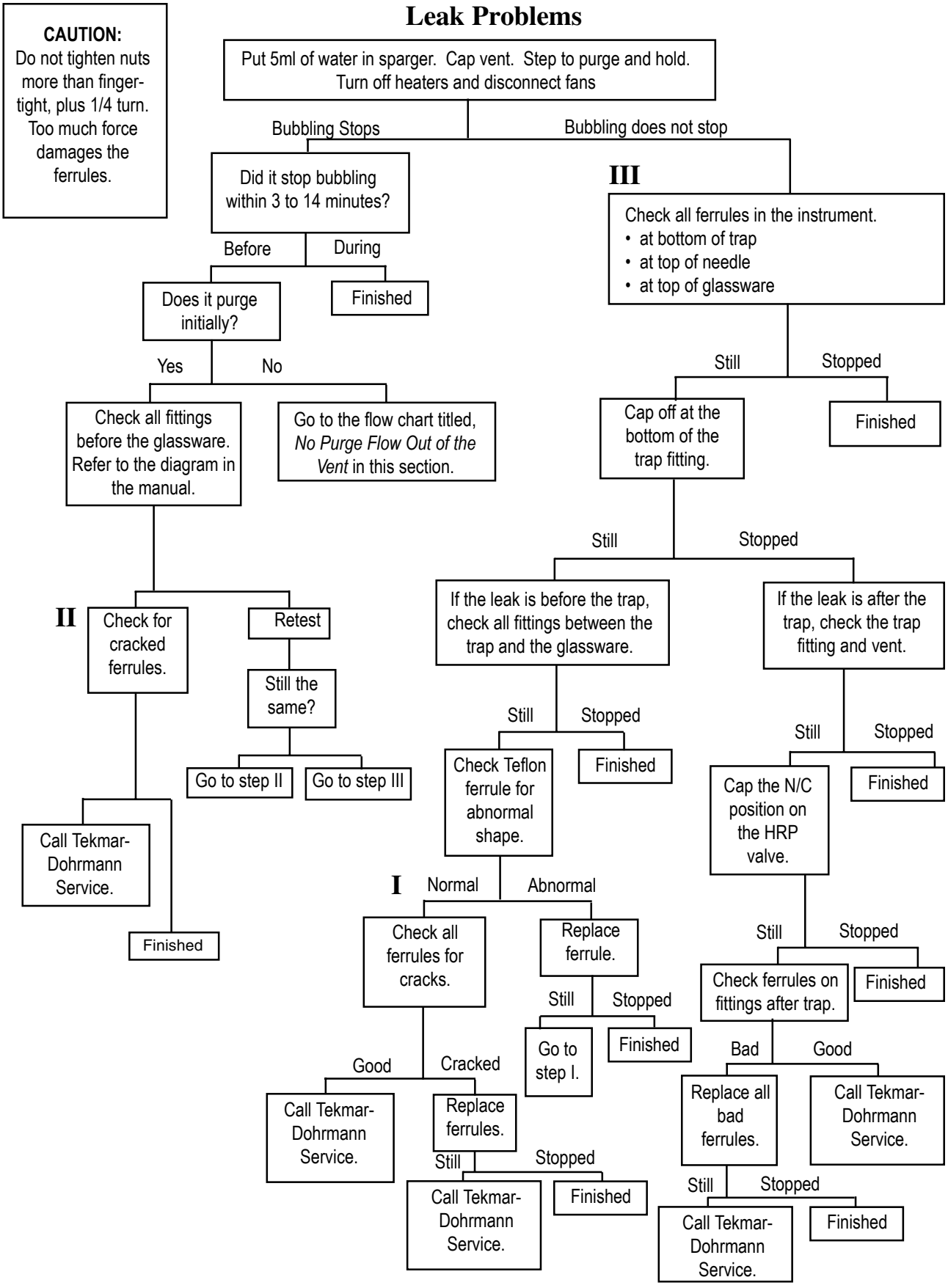
* Make sure that the 3100 is off and unplugged. Insert the end of a small, slotted screwdriver into the notch on the power module. With the screwdriver, gently pry the fuse holder out of the power module.

No Purge Flow Out of the Vent

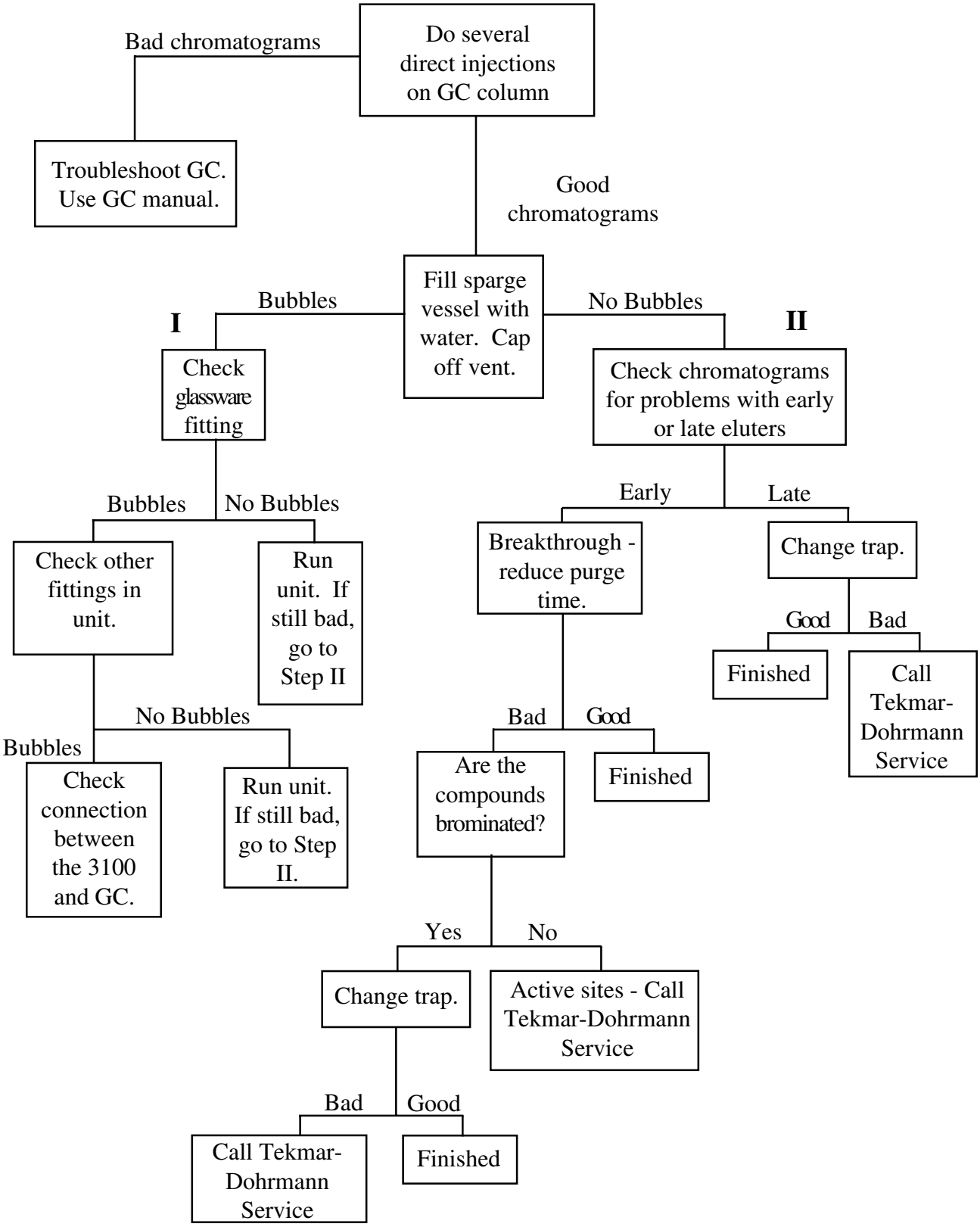


* To check for leaks, see the leak problems flow chart in this section.

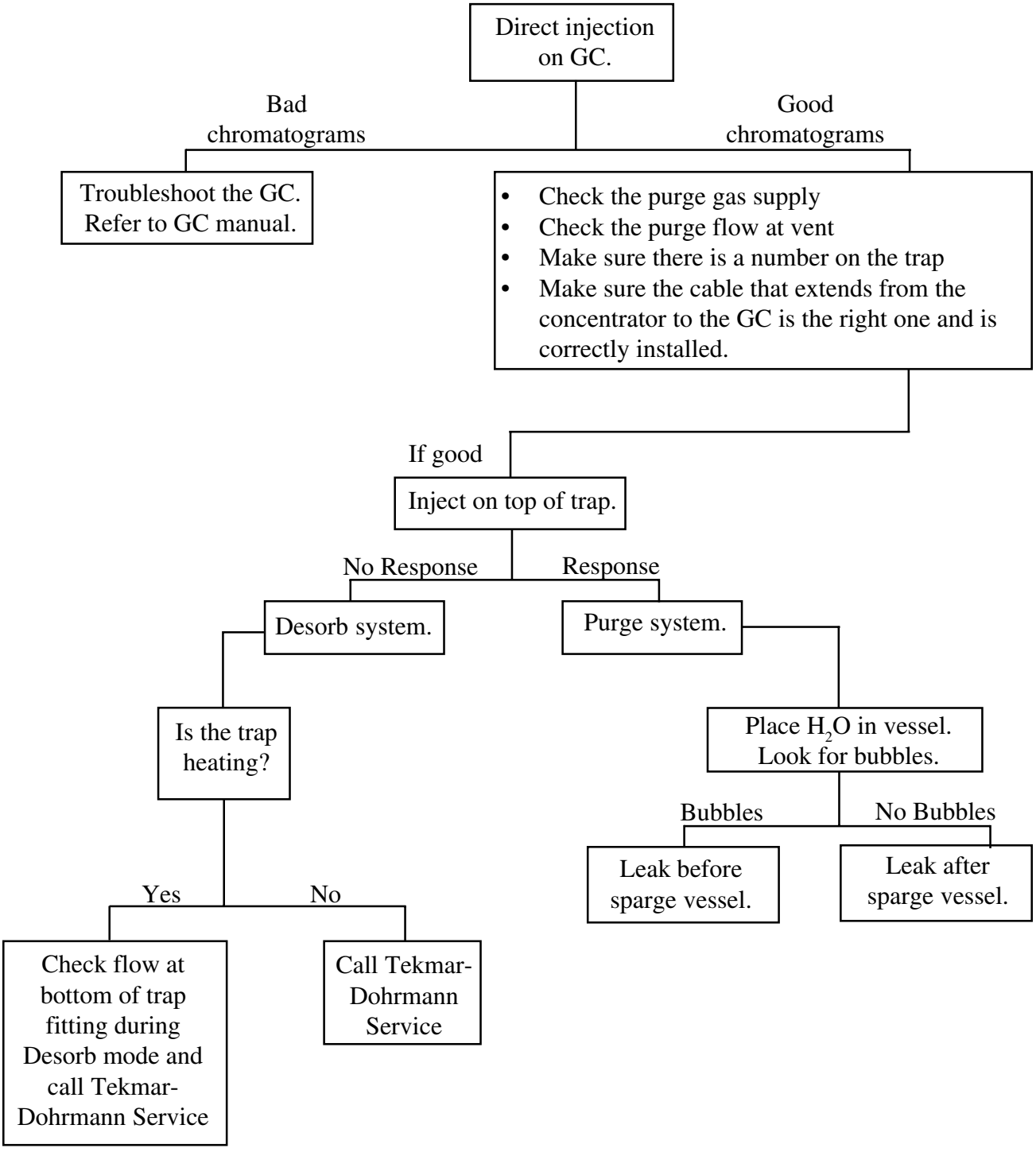
Leak Problems



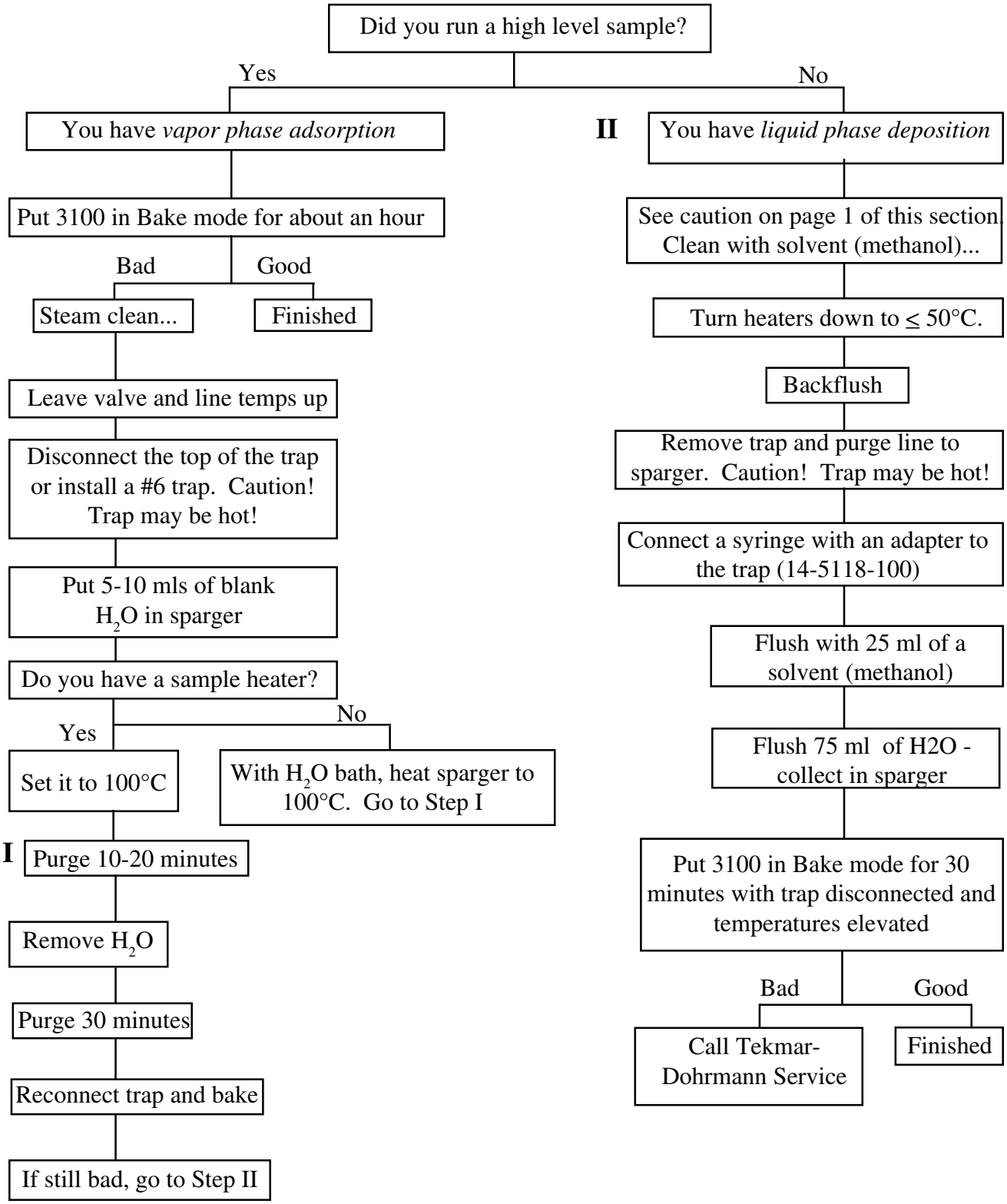
Reduced Sensitivity



Lack of Response



Carryover Contamination



SERVICE AND PARTS

Chapter 10

10.1 Calling Sales or Service

To order parts, ask technical questions, or obtain service, call one of the following numbers:

- (800) 543-4461 - toll-free in the US and Canada
- (513) 247-7000 - outside the US and Canada

Before you call for service or parts:

- Note the model name, model number, and serial number of the instrument.
- If requesting assistance or service, note the type of problem you are having: write down the conditions under which the problem occurred and the display, activity, or result that indicated the existence of a problem.
- When ordering parts, write down the part number, part name, and quantity needed.

10.2 3100 Parts List

This section lists part numbers and names for 3100 replacement parts. which are listed by type.

10.2.1 Glassware

14-2337-024	5ml Frit Sparger (glassware only)
14-2334-024	25ml Frit Sparger (glassware only)
14-2336-024	5ml Fritless Sparger (glassware only)
14-2333-024	25ml Fritless Sparger (glassware only)
14-2052-024	5ml Needle Sparger (glassware only)
14-2053-024	25ml Needle Sparger (glassware only)
14-3096-100	5ml Frit Sparger Kit
14-3095-100	25ml Frit Sparger Kit
14-3094-100	5ml Fritless Sparger Kit
14-3093-100	25ml Fritless Sparger Kit
14-3599-100	5ml Needle Sparger Kit
14-3600-100	25ml Needle Sparger Kit
14-4817-024	5ml Fritless Sparger, right intro stem for use with 2050 or AQUATek 50
14-4818-024	25ml Fritless Sparger, right intro stem for use with 2050 or AQUATek 50
14-3544-024	5ml Frit Sparger, w/left introduction stem for 2050 or AQUATek 50
14-3546-024	25ml Frit Sparger, w/left introduction stem for 2050 or AQUATek 50
14-3544-124	5ml Frit Sparger, w/right introduction stem for 2050 or AQUATek 50
14-3546-124	25ml Frit Sparger, w/right introduction stem for 2050 or AQUATek 50

10.2.2 Sample Handling

14-5684-000	Sample Valve, 3-Port Assembly
14-0216-016	Female Luer Connector for Sample Valve
14-5682-202	Drain Line Assembly
14-5681-102	Purge Line Assembly
14-0036-050	Sample Valve, 3-Port
14-3196-053	Sample Needle, 25ml 9 1/8", for 25ml frit sparger, 25ml fritless sparger
14-3595-053	Needle, 7.75" for 5ml frit sparger, 5ml fritless sparger
14-5186-053	Needle, pointed, 7.75" 16GA, .009" wall, for 5ml needle sparger
14-5186-453	Needle, pointed, 10.25" 16GA, .009" wall, for 25ml needle sparger

10.2.3 Syringes

14-0122-016	Male Luer Fitting for Syringe Valve
14-0069-052	5ml Sample Syringe w/Luer Connector
14-0070-052	25ml Sample Syringe w/Luer Connector
10-0089-052	10 ml Calibration Syringe
14-0114-050	Syringe Valve, 2-port with Luer Connector

10.2.4 Traps

14-4045-403	GLT Trap 6G
14-4046-403	GLT Trap 7G
14-4047-403	GLT Trap 8G
14-4939-403	GLT Trap 9G

10.2.5 Tubing

14-0539-002	Tubing, Fused Silica 0.32 mm ID
14-2072-002	Tubing, Fused Silica 0.53 mm ID
14-5229-002	Tubing, 1/16", Nickel, Large Bore Purge and carrier gas to BOT pathways
14-5540-002	Tubing, ElectroForm .04 I.D. .06 O.D. (used in sample pathway)
14-5543-002	Tubing, Electroform .02 I.D., transfer line
14-5283-102	Tubing, ElectroForm 1/16 Set (2 pieces - purge lines)

14-5228-002	Tubing, 1/16" Nickel, Small Bore Line between HRP valve and brass tee
14-3845-002	Tubing, 1/16" Nickel, Large Bore Flexible
14-3125-002	Tubing, Hypodermic SS, 16 GA
14-0583-002	Tubing, 1/8", Teflon, FEP
14-6104-002	Tubing, Silcosteel, Non-Polar, 1/16OD, .04ID
14-6085-002	Tubing, Silcosteel, 1/16OD, .02ID

10.2.6 Fittings

14-5773-016	Ferrule, 1/8", Valco, gold
14-5495-016	Union, 1/4" to 1/16"
10-0064-016	Union, 1/8" to 1/8" stub, brass, bulkhead
14-0241-016	Ferrule, 1/16", SS, single piece Valco
14-0051-016	Union, 1/16", brass
10-0073-016	Union, 1/8", brass
14-3404-016	Union, 1/16" SS, Swagelok, without ferrules
14-4824-116	Union, reducing, 3/4" x 1/2"
14-0050-016	Union, 1/8" to 1/16", SS
14-0264-016	Union, bulkhead 1/16" SS
14-0356-016	Union, bulkhead 1/8" filter assembly
14-5685-016	Union, 1/16" Brass
14-4695-016	Union, tee, 1/16" Brass
14-0241-016	Ferrule, 1/16", SS, single-piece Valco
14-0158-016	Ferrule, 1/16", SS, Swagelok
14-5663-016	Ferrule, 1/16", Teflon
14-1301-016	Ferrule, 1/2", Teflon
10-0041-016	Ferrule, 1/4" Teflon
14-1301-016	Ferrule, 1/2", Teflon
14-0521-016	Ferrule, 0.4 mm I.D. graphite/vespel
14-0540-016	Ferrule, 0.5 mm I.D. graphite/vespel
14-2074-016	Ferrule, 0.8 mm I.D. graphite/vespel
14-2931-016	Ferrule, 1/16" I.D. graphite/vespel
10-0408-016	Ferrule, set 1/8" SS

10-0043-016	Ferrule, Teflon, 1/8" set
14-2931-016	Ferrule, 1/16", graphite/vespel
14-3123-016	Ferrule, 1/16", Upchurch ETFE
10-0405-016	Nut, for 1/8" fitting SS
14-4602-016	Nut, 1/8", SS, Valco
14-3124-016	Nut, short blk, 1/16" Upchurch
14-0159-016	Nut, 1/16", SS, Swagelok
14-0243-016	Nut, 1/16" short
14-3295-016	Nut, 1/16", SS male, Swagelok
14-2792-016	Nut, cap, 1/16" brass
10-0076-016	Nut, plug, 1/8" brass
14-6216-016	Tee, 60 degree side port
14-5302-016	Elbow, 1/8" - 1/16" bulkhead SS
10-0042-016	Reducer, 1/16"-1/8" tube stub
14-5686-016	Bulkhead, 1/8" - 1/16" SS, with filter
10-0338-016	Bulkhead, 1/8" SS, with filter
14-7037-016	Fitting, Flangeless Nut, 1/8"
14-7038-016	Bushing, Exit, 1/8" TEFZEL, short
14-6216-316	Tee, Silcosteel, 3100
14-5302-116	Bulkhead, 1/8" - 1/16", Silcosteel coated

10.2.7 Heaters

14-5736-000	Kit, pocket sample heater
14-5736-100	Kit, tube heater
14-5717-220	Heater assembly, trap
14-5718-020	Heater assembly, bottom of trap
14-5307-020	Heater, transfer line 72"
14-5687-020	Heater, cartridge assembly (oven)
14-5691-079	Plate, machined, valve oven
14-5555-026	Thermocouple, type K 16" (oven)
14-5654-120	Heater assembly, MCS, with heat sink
14-6108-120	Mount, Heated Sample, Silcosteel, 3100
14-5717-220	Trap Heater, 115VAC, for 1/8" x 12" lg. trap

10.2.8 Valves and Pneumatics

14-5298-050	Valve, 6-port, 350°C
14-5298-150	Actuator, 6-port valve, 3100 spare
14-5529-050	Valve, assembly, sample 12 VDC
14-5527-050	Valve, assembly, bypass 12 VDC
14-5530-050	Valve, assembly, vent 12 VDC
14-5716-050	Valve, assembly, HRP 12 VDC
14-5526-150	Assembly, Drain Valve, 1/8" Line, 12 VDC
14-5675-150	Pressure Regulator, 1/16" fitting with guage6
14-4570-000	Pressure Gauge assembly, 0-30 PSI
14-5522-050	Flow Controller, 0-100 cc/min
14-5285-267	Loop, MCS, 600-650µl, Silcosteel coated
14-1362-000	Hydrocarbon Trap Assembly
14-5092-000	Installation Kit
14-5778-050	Valve, Needle (TPC) 1/16" tubes

10.2.9 Electronics

14-5330-090	PC Board Assembly, Cryofocusing Module Logic
14-1719-050	PC Board Assembly, Actuator
14-5233-090	PC Board assembly, Microcontroller
14-5393-390	PC Board assembly, Memory 3100
14-5235-090	PC Board assembly, Comm/Interface
14-5749-090	PC Board assembly, Output
14-5310-090	PC Board assembly, Interconnect
14-5315-090	PC Board assembly, Thermocouple
14-5329-090	PC Board assembly, Autosampler Card
14-7434-090	PCB Assembly, LED, 3100
14-5297-191	Display assembly, LED with connector
14-5439-080	Cover, Display Clear
14-5528-086	Modular Jack with Cable
14-3027-000	Cable, 6-port Valve
14-5558-086	Cable, 6 pin Modular, Coiled
14-5321-080	Expansion Slot Cover (thermocouple)
14-0298-039	Power Cord, 110V

14-5291-038	Transformer assembly, 110V - 24V/8V
14-5177-238	Transformer assembly, 100V -110V
14-5634-600	Wiring kit, main, 110V
14-4383-028	Switch, power, 10 amp filtered
14-5634-700	Power lead, trap 25"
14-5634-100	TC Extension, trap 25"
14-5634-200	TC Extension, BOT 13"
14-5634-300	TC Extension, MCS 8 1/2"
14-5634-500	Cable display, 21"
14-5180-034	Fuse, 10A, 250V 5 x 20 mm
14-4961-034	Fuse, 4 amp 5 x 20 mm
14-5757-034	Fuse, 4 amp, sub-min, fast for output module
14-4738-028	Switch, interlock, 125 VAC (trap)
14-5740-058	Output module

10.2.10 Low Volume Inserts

14-4952-000	Low Volume Insert, HP 5890 Packed Injector
14-4952-100	Low Volume Insert, HP 5890 Purged Packed Injector
14-5506-000	Low Volume Insert, HP 5890 Split/Splitless Injector
14-4633-000	Low Volume Insert, Varian (except Varian 1075 Capillary Injector - available soon)
14-4634-000	Low Volume Insert, Perkin Elmer 8000 Series, Sigma 2000 and 2100 GCs (will not work on Autosystems,Sigma Ib-4b and 300 Series GCs)
14-4635-000	Low Volume Insert, Tracor 540, 585
14-4635-100	Low Volume Insert, Tracor 560, 565, 570
14-4635-200	Low Volume Insert, Tremetrics 9000

10.2.11 Septum Needle Adapters*

14-4913-153	Septum Needle Adapter Kit, Varian 1040/ 1041 Packed Injection Port
14-4913-253	Septum Needle Adapter Kit, Hewlett Packard 5890A Capillary Injection Port
14-4913-353	Septum Needle Adapter Kit, Hewlett Packard 5880A and 5890A Packed Injection Port.
14-4913-453	Septum Needle Adapter Kit, Varian SPI 1075/1077 and Tracor 540 Injection Ports
14-4913-553	Septum Needle Adapter Kit, PE Sigma 2000 Series
14-5009-043	Septum Replacement for Septum Needle Adapter-Pack of 5 Septa

10.2.12 Septum Nuts

14-1591-110	Septum Nut, Varian 1040/1041 Injection Port.
14-5036-010	Septum Nut, Hewlett Packard 5890A Capillary Injection Port.
14-5036-110	Septum Nut, Hewlett Packard 5890A Packed Injection Port.
14-1591-410	Septum Nut, Varian SPI 1075/1077 and Tracor 540 Injection Ports
14-1591-510	Septum Nut, Perkin Elmer, all Sigma Series, all 800 Series and Autosystem Injection Ports.

10.2.13 Interface Cables

14-2991-000	Interface, Hewlett-Packard 5890 GC
14-4188-086	Interface, Hewlett-Packard 5890 w/5970 MSD and Unix or Pascal-based software[1]
14-4652-086	Interface, Hewlett Packard 5890 w/5970 MSD and Unix-B or MS-DOS software, HP 5890/5971/5972 MSD and Unix-B or MS-DOS software, and HP 5890/5989 MS Engine
14-2993-000	Interface, Hewlett-Packard 5995/96/85/87/88/92 GC/MS with HP-1000/RTE GC/MS Software, HP 5890 w/5970MSD and RTE (RTE-A, RTE-6, or Rev F[2])
14-2974-000	Interface, Hewlett-Packard 5700 Series (exc. 5710/30/90)
14-2976-000	Interface, Hewlett-Packard 5710/30/90 GC w/5970 MSD with Chemstation using Quicksilver Software
14-2990-000	Interface, Hewlett-Packard 5880A/5840A
14-3318-000	Interface, Hewlett-Packard 5995/96/87/85/92 w/Chemstation-Quicksilver
14-3010-000	Interface Kit, Hewlett-Packard 5995/85/9392 GC/MS (includes I/O box). requires HP's BATCH or AQUARIUS Software and external events relay board to operate with SIDS Data System
14-6689-086	Interface, Hewlett-Packard 6890 Series GC
14-2968-000	Interface, Varian 3300/3400/3500/3600 with or without serial I/O
14-2969-000	Interface, Varian 3700
14-3052-000	Interface, A & B to Varian Vista I/O Box
14-2972-000	Interface, Tracor 560/565/670
14-2992-000	Interface, Tracor 540 and Waters Dimension I
14-3430-000	Interface, Tracor 585/9000 and Waters Dimension II
14-2970-000	Interface, Perkin-Elmer Sigma Series

14-3233-000	Interface, Perkin-Elmer 8000 Series/ Autosystem
14-2973-000	Interface, Shimadzu GC9A
14-4610-086	Interface, Shimadzu GC 14A/15A, GC 14A w/QP 1000 EX MSD and GC 14A w/QP 2000 MSD
14-4009-000	Interface Splicer Cable, Finnigan 5100/4000/ 4500 and OWA
14-4938-086	Interface, Carlo Erba Mega/Vega Series and Fisons 8000
14-3147-000	Interface, General Purpose/HNU 301/321/ 421[3]

[3] Valve driver option necessary from HNU.

10.2.14 Miscellaneous

14-5118-100	Kit, Solvent Flush
14-5959-000	Kit, Desorb, 1/4" x 7"
14-5525-019	Blower assembly, 60 CFM 115V
14-5524-219	Fan assembly, 3 1/8" SQ, 14" Leads
14-5524-319	Fan assembly, 3 1/8" SQ, 11" Leads
14-6000-217	Carton, Shipping, with Foam
14-3100-074	Manual, User, 3100
14-5765-176	TekLink, 3100
14-5306-185	Panel, Front, 3100

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